RAILROAD GAZETTE

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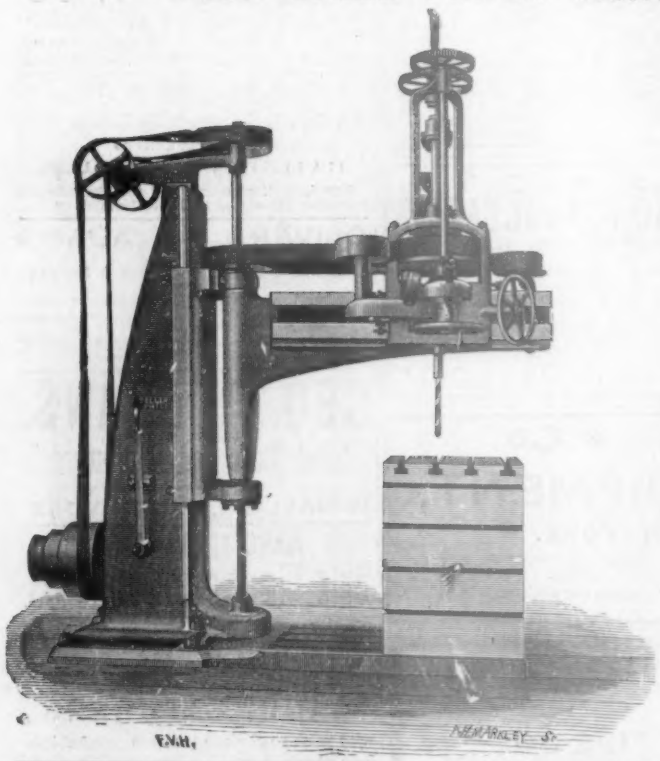

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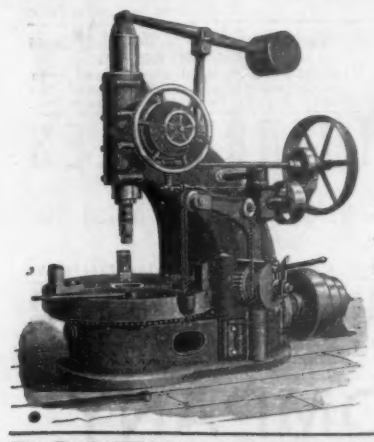

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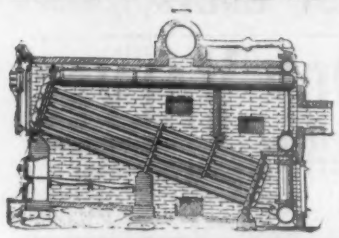

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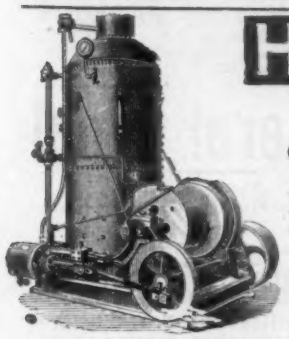

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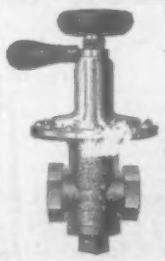

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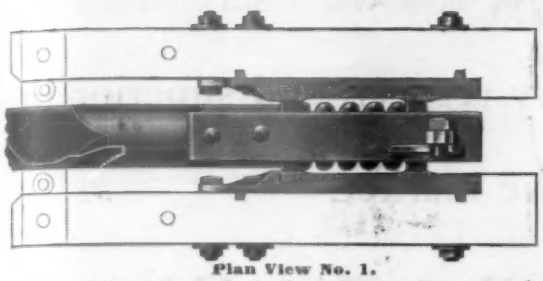

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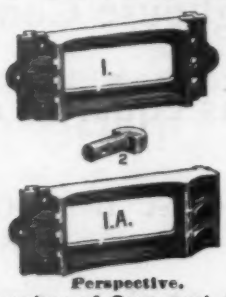

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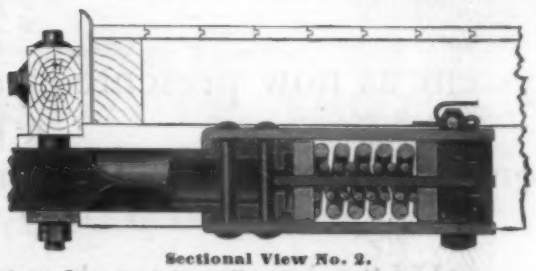

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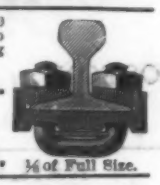

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Hinson Draw Bar Attach 3
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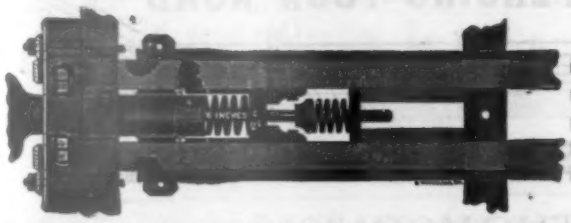

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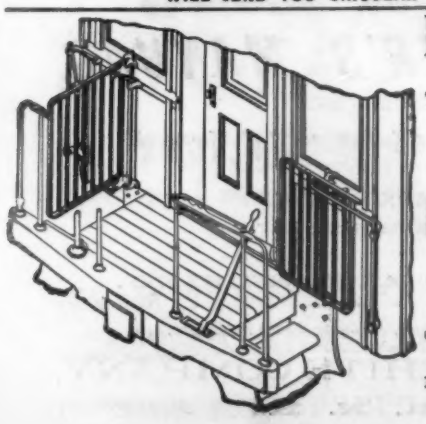

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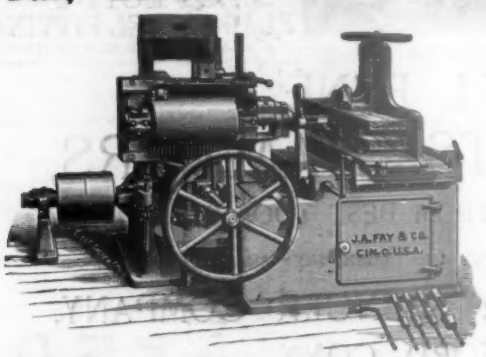

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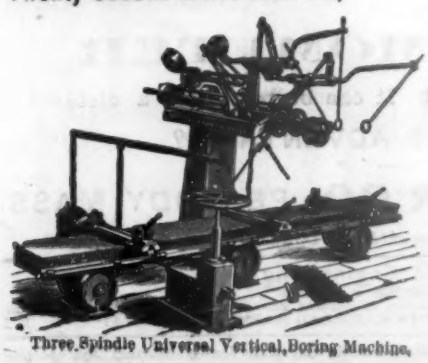

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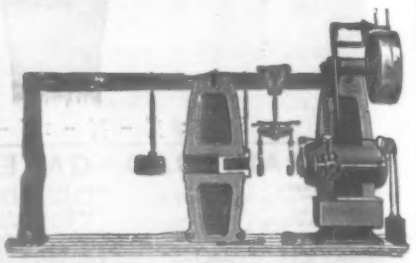

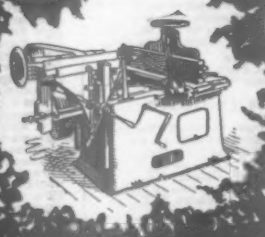

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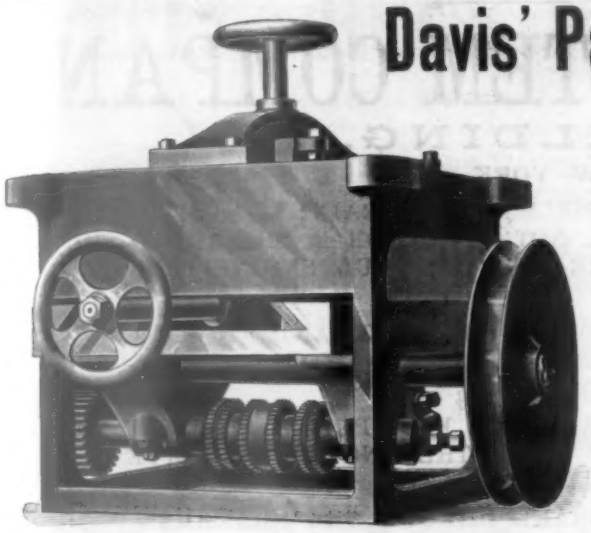

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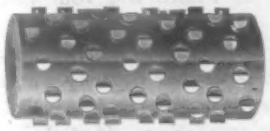

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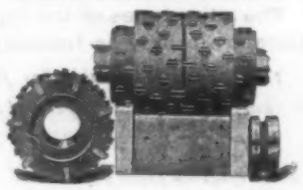

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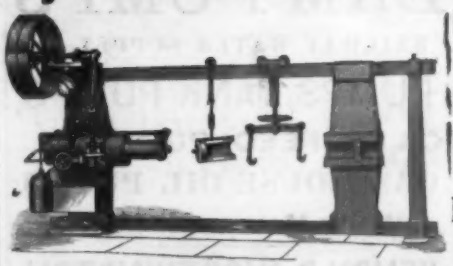

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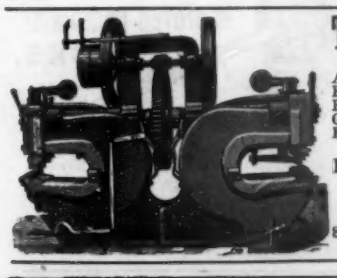

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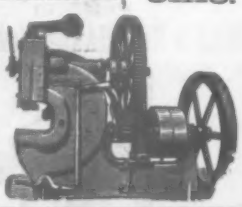

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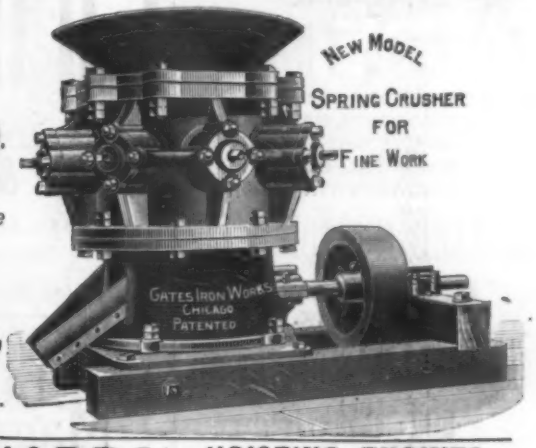

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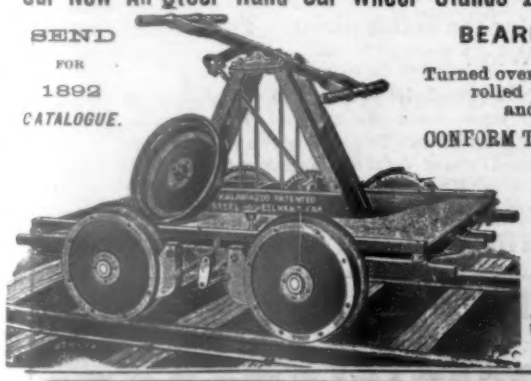

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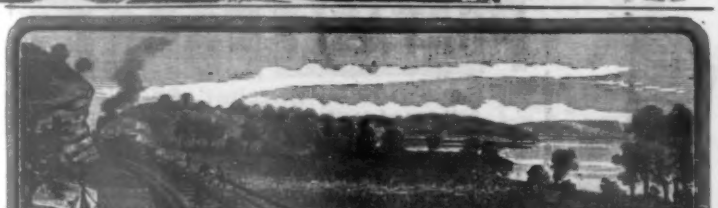

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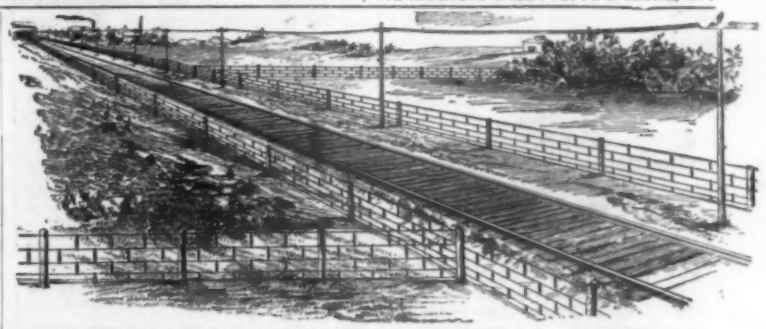

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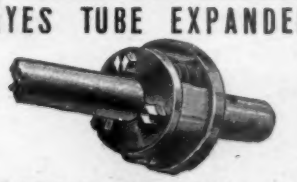

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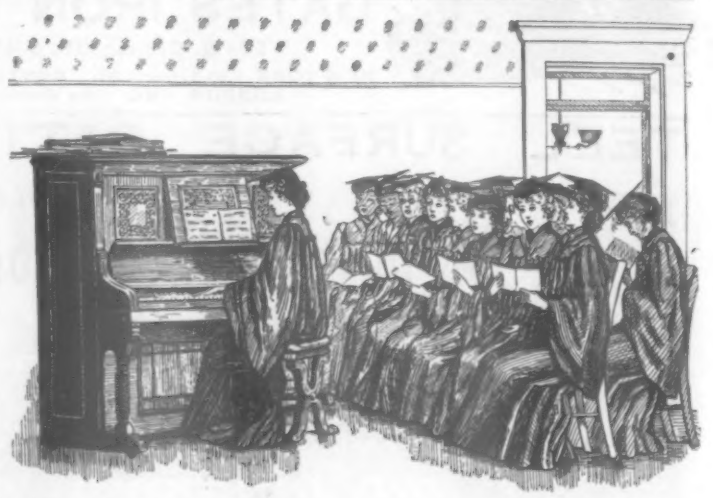

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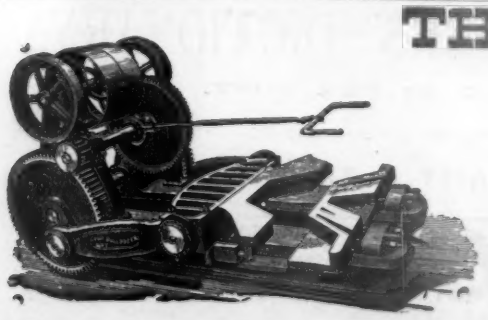

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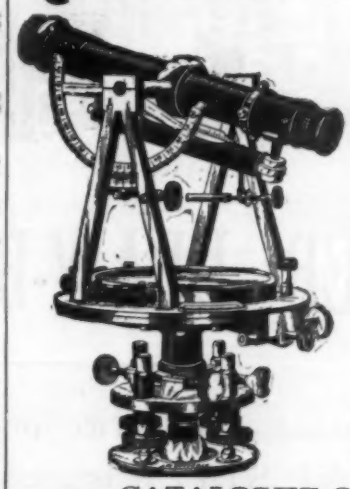

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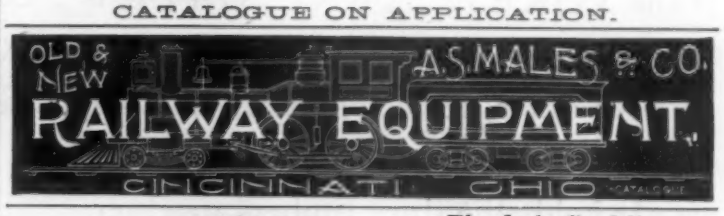

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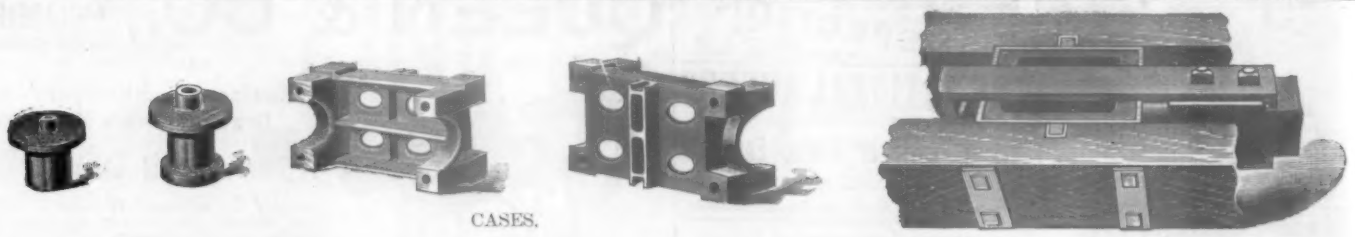

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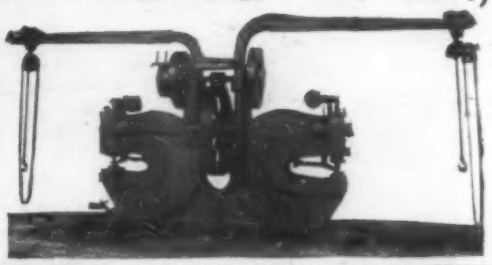

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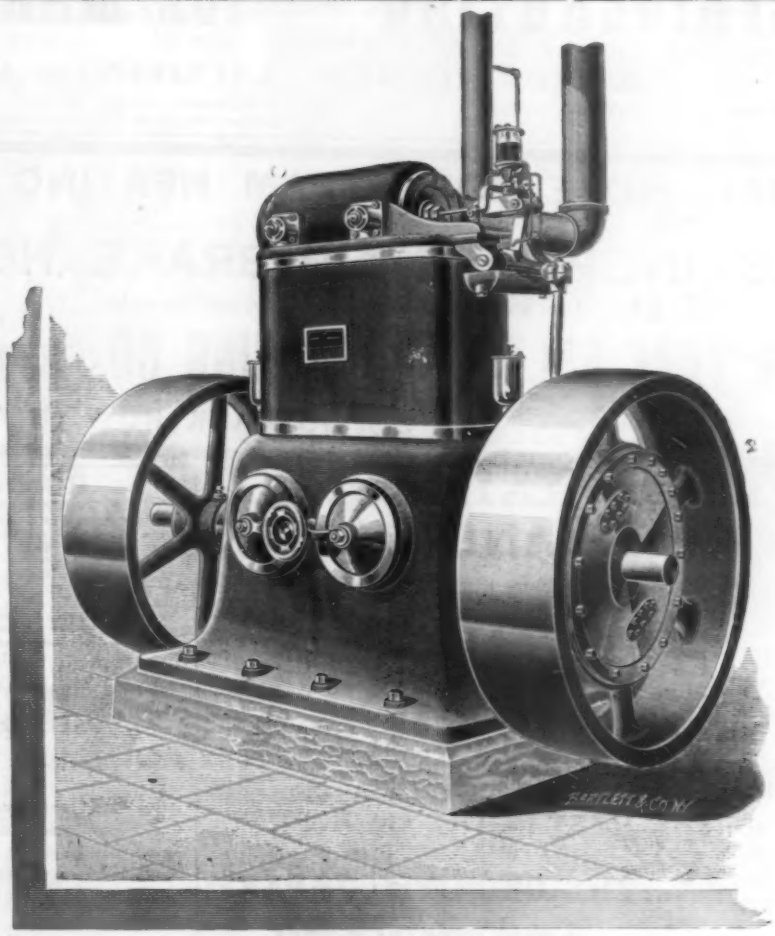

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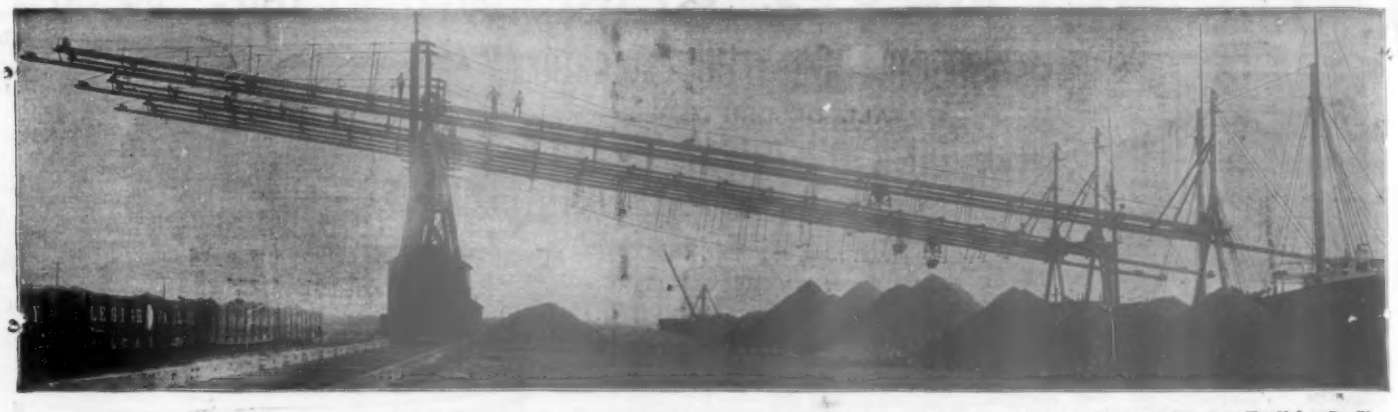

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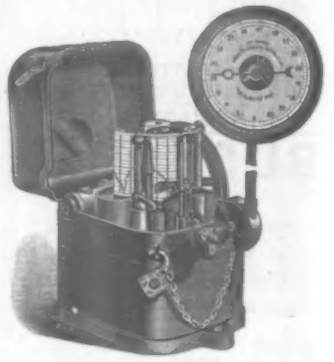

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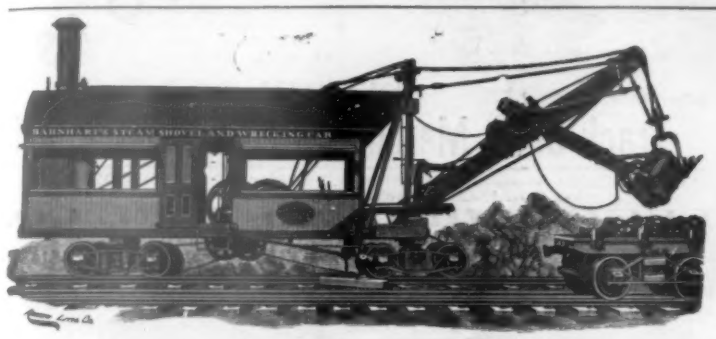

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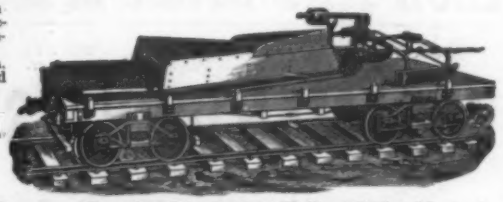

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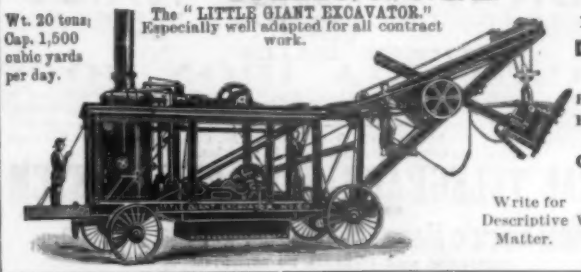

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The ONLY Locomotive Steam Gauge made where the Movement, Springs and all Moving Parts are Detached from the Back of the Case.

Case Fitted with our Patent Elastic Packing to Prevent Dust and Moisture from Entering Gauge.

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TUNNELS, QUARRIES, MINES, RAILROADS,

And Wherever Ore and Rock are to be drilled and blasted.

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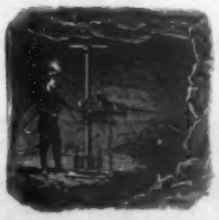

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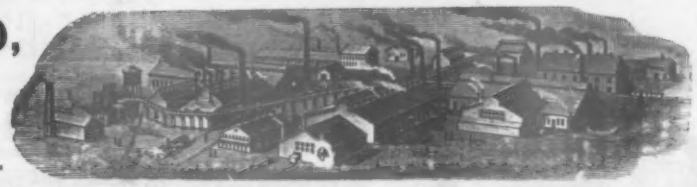

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The Union Pacific Railway has used our instruments since August, 1889, with absolute success, and other railroads are using them with equal satisfaction. It is the only practical individual Telegraph Call Bell yet invented.

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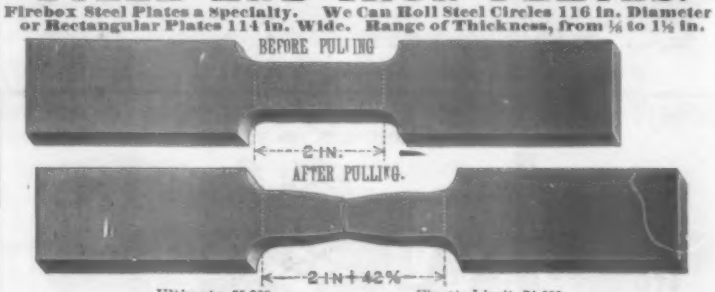

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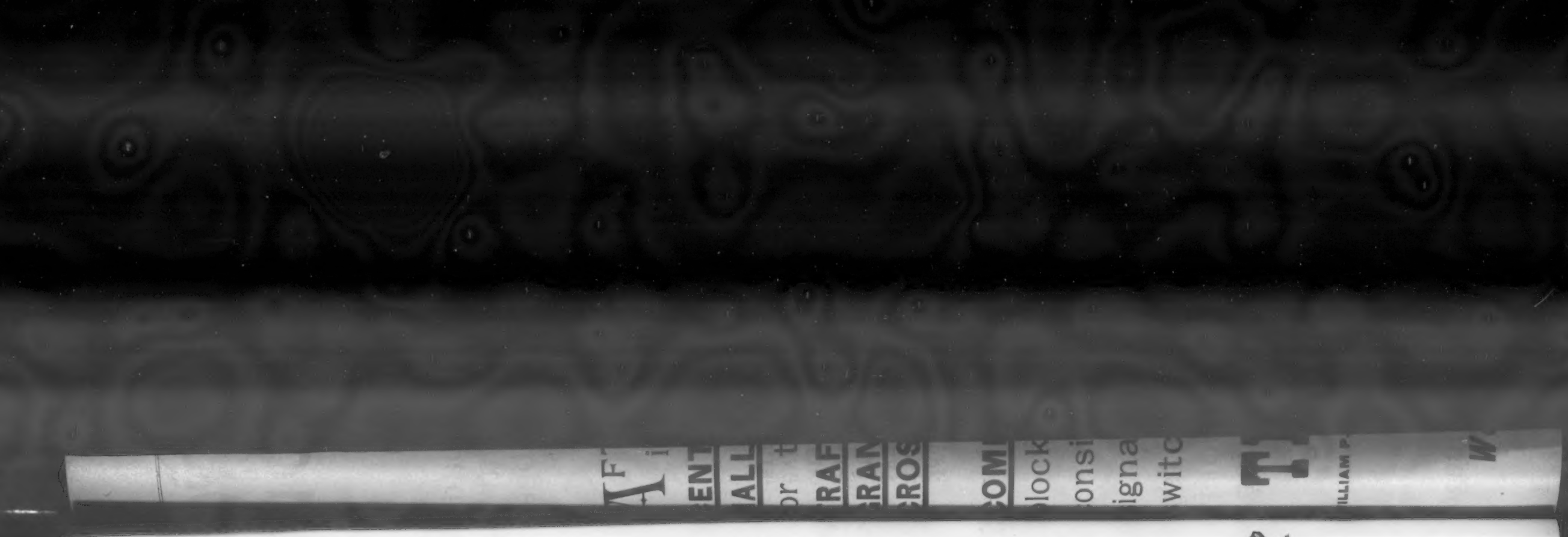

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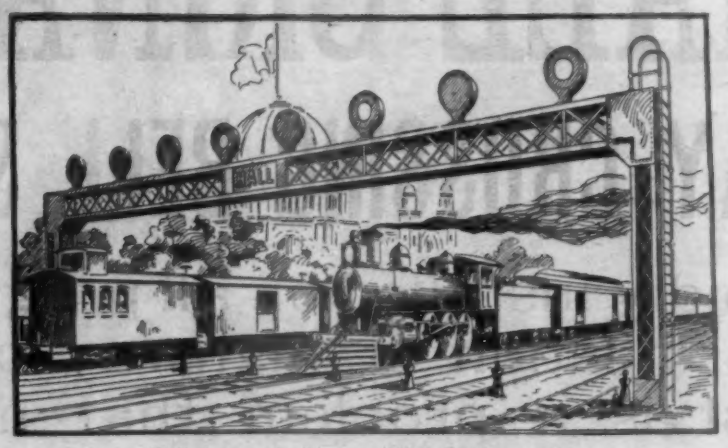

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AFTER the most thorough investigation ever made into the subject of block signals **THE ILLINOIS CENTRAL RAILROAD COMPANY HAS ADOPTED THE HALL SYSTEM OF AUTOMATIC ELECTRIC SIGNALS** for the protection of their entire **WORLD'S FAIR TRAFFIC** on their eight tracks from **CHICAGO** to **GRAND CROSSING** and four tracks from **GRAND CROSSING** to **KENSINGTON.**

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The proper protection of highway crossings at
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THE EXPENSE OF FLAGMEN FOR BOTH NIGHT AND DAY SERVICE PLACES SUCH A SYSTEM OF PROTECTION BEYOND THE CONSIDERATION OF MANY ROADS.

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VAUCLAIN'S PATENT.

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THE STANDARD STEEL WORKS,

PHILADELPHIA.

STEEL TIRES

Manufactured by an Improved Process, Insuring Solidity.

WROUGHT IRON CENTRES.

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Particular attention is called to the fact that the Standard Steel Works is making under Vauclain's patents the Only Wrought-Iron Spoke Centre made in the United States. This is a perfect forging, and we invite comparative tests with other Centres.
Wheels will be furnished with any form of Tire Fastening.

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This device will not successfully handle **all waters,** but there are **none** that it will not improve. In a **large majority** it will demonstrate great economy.

The apparatus can be made at railroad shops at small expense.

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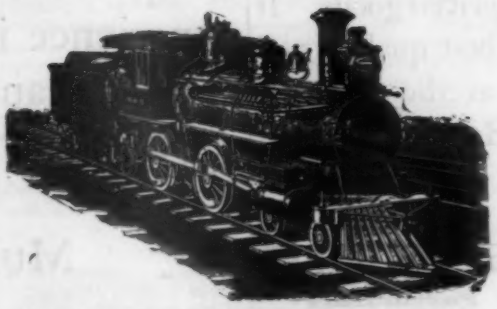

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The National Electric Headlight is an arc light of 2,000 candle power, placed in an ordinary case of the usual style, with the ordinary reflector. It is run by a small dynamo placed immediately behind the light, which is supplied with steam by a pipe from the cab. The engineman from his seat can instantly shut off or turn on the steam, and thus extinguish or relight the lamp, as desired. Three years unvarying success in use. Send for detailed testimony, full description and terms. Trial headlights furnished.

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"The most useful hand-book in the language for the engineering profession."—*Engineering and Mining Journal*, Aug. 25, 1888.

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Solid Braided Cord for Railroad Service.

SAMSON CORDAGE WORKS.

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EDWARD SMITH & CO., RAILWAY VARNISHES, Times Building. NEW YORK

RAILROAD GAZETTE

FRIDAY, OCT. 14.

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A Big Bridge by Rail.

The Hamilton Bridge Co.
HAMILTON, Can., Oct. 3, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of the 23d ult. is given a description of the shipping of a long plate girder of 120 ft., as being "probably the largest shipment of the kind ever made by rail."

It may be of interest to some of your readers to know that even up here in Canada we can beat that record somewhat. In December of last year this company designed and built a plate girder swing bridge for the Grand Trunk Railway. It was built complete in the shops,—the two girders and crossbracing, and shipped and erected in one piece. The total length was 134 ft. 7½ in.; breadth from c. to c. of girders, 8 ft.; depth of girders, 8 ft. 5½ in., and weight, 138,145 lbs., or a little over 69 tons. It can be seen at Port Robinson as it was shipped.

J. A. MCNICOL.

Lighting the Sault Ste. Marie Canal and River.

United States Engineer Office,
DETROIT, Mich., Oct. 8, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I am in receipt of yours of the 7th inst., making inquiry in regard to the lights at St. Mary's Falls Canal, and have to say that electric lights have been in operation on the canal for several years, and that there has been no difficulty in navigating the canal either day or night.

I presume, however, that you refer to the lights on St. Mary's River for the 60 miles below the canal. Forty-three of the lights, that is to say, between Pipe Island and Sault Ste Marie, have been established this season, and complete the system proposed by Colonel Ludlow and Captain Heyerman, late Engineer and Inspector, Eleventh Light House District. By the aid of these lights many vessels have navigated the river, which theretofore was not navigable at night, but it cannot be said that the river is as readily navigable by night as by day. Such condition is practically impossible. Even a street cannot be so lighted as to be as readily traversed at night as by day.

It is not supposed that the establishment of the lights referred to on St. Mary's River will materially increase the capacity of the canal, but it will diminish the length of delays in proportion as the vessels avail themselves of the improved condition of the river in regard to navigability at night, because it will distribute more uniformly the time of their arrival at the canal. Heretofore they so timed their upward bound voyages as to reach the canal from below before night, and if arriving at the canal, bound down, with less than three hours of daylight before them, they were locked through and then were compelled to wait until next morning before proceeding. The canal will be relieved to some extent, because the vessels will not be "bunched" as formerly; but we are not able yet to estimate the effect of the improved conditions.

O. M. POE,
Colonel Corps of Engineers,
Bvt. Brig. General, U. S. A.

Some Remarks on Car Couplers.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Permit me to bring to the notice of those contemplating the selection of M. C. B. couplers a few of the points essential and necessary for the make-up of couplers that will perform the labor expected of them.

In the October number of the *Railway Master Mechanic* appears an article which in some respects is much in error as to what is actually required. In the last portion of the sixth paragraph the writer makes the following remarks: "To provide for simplicity and certainty of action it is desirable that the appliance for unlocking the coupler should be made to perform this function"—that is, open the knuckle.

I do not hesitate to say that any device for opening the knuckle from the side of the car by means of the uncoupling mechanism cannot be a success. I have taken the liberty and time to look up their service records, and am obliged to say that devices of that kind are such utter failures in the performance of their duties that it is doubtful if any other device aside from the action of a spring can be made to do the automatic act.

The writer has also concluded that when the automatic action is to be performed by the trainmen the coupler is not an automatic, or a very safe one. There are many times when cars are thrown for shifts under speed. In this event the couplers should depend entirely upon automatic action and prevent danger to trainmen performing the hazardous labor. It is also a positive fact that the chain connections of uncoupling devices fail from some cause or other to remain intact any length of time, which is not well adapted to prevent the boys from going between the cars; therefore, is it not about time to take an advanced step in the art of couplers and their selection?

In reference to the heads breaking off and falling on the track the best remedy in this respect is to select such equipments as will obviate such dangers. They are now on the market. Why not use them? This would be the cheapest and most satisfactory way out of the wreck.

The whole subject comes down to one focus point; of what value is a coupler if it has one very weak point which necessarily will kill the rest if the bad feature is not removed? Hence the necessity of bringing the couplers up to a standard that will have no parts easily detached, broken or made inoperative. In all my observations up to date there are but three couplers which have ventured to displace the weak features of chain connections by devices which will remain intact. However, we are perpetually bombarded by those who have no such devices, or by journals which have failed to look into the matter sufficiently to know a weak point from a strong one when they see it.

Since writing the above I have seen seven couplers out of 12 of the latest improved chain connected M. C. B. type, which were disconnected from the couplers and three of the devices lost entirely. They were new cars and in service about 30 days.

W.

The Servis Tie Plate and Spike-Shearing.

NEW YORK, Oct. 6, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In reply to the letter of Benjamin Reece concerning the Servis tie plate, in which the series of attacks against me by the Q & C Co. is continued, I would state that the shearing of the Servis tie plate in June 1891, on the 10° curve on the Western New York & Pennsylvania Railroad at Rochester, was reported to me at that time by the Division Engineer of the road orally. A recent letter from me to that gentlemen in regard to the details of this matter was answered as follows:

Western New York & Pennsylvania R. R. Co., Rochester Division.
ROCHESTER, N. Y., Sept. 24, 1892.

James Churchward, Esq., C. E.

DEAR SIR: Regarding the Servis tie plates used on this division by your request (while you represented the Servis people), at the end of the lead rails, at the heel of the split switches, I would say that they were a failure. In every case the spikes were sheared, and generally the plates buckled or broke; they have all been taken out I think. The Servis plate is an excellent tie preserver, but where there is considerable pressure exerted against the gauge side of the rail they should be supplemented with a rail brace to save the spikes. In the case of the heel of split switches this cannot be done. If your C. A. C. plate will stand this test and not break in two at the rib, and retain this movable joint to gauge, you have something that all maintenance of way men will appreciate. Regarding the shearing of spikes on an extremely sharp lead of one of our switches, I cannot give any definite particulars as recent changes have obliterated any evidence that would be trustworthy.

C. R. NEHER, *Division Engineer.*

My only object in requesting the insertion of this letter is to justify the good faith of my statements and reports to the Q & C Co., in consequence of the accusations of malice and slander made against me in previous communications in your paper by that company.

In future their attacks upon me will remain unnoticed, as personal differences can have no public importance.

JAMES CHURCHWARD, C. E.

ROCHESTER, N. Y., Oct. 8, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Quoting yours of Oct. 6, in which you state "that hereafter you will publish nothing with regard to this unfortunate discussion without first submitting it to all parties interested," it would have been well if you had taken this course at the outset. Inasmuch as I have been brought into this discussion without a hearing, or to my knowledge until after publication, and have been made to appear in an equivocal light, I would thank you also to give me a hearing.

The statement made by Mr. Churchward, and printed in the *Gazette*, regarding shearing of spikes with Servis tie plates in June, 1891, on 10° curve at Rochester, on the W., N. Y. & P. R. R., and ascribed as emanating from me, is false. We have never had such an accident, and I have never made such a statement. I did put some tie plates to a severe test on a sharp curve, which necessarily had but a little elevation—a switch lead in our yard here. The spikes eventually cut under the head to such an extent that the plates were taken out. As the plates covered so much of the ties that there was no room in the heart of the ties for additional spikes, the plates were single punched. At the time the plates were removed none of the spikes were cut entirely in two, as it would have been simple negligence to have let them go so far, and no accident resulted.

I also, at Mr. Churchward's request, while he was with the Q & C people, used some of the plates at the end of the switch leads, at the heel of split switches. The spikes in every instance that I have knowledge of were sheared off in the course of from two to six months.

This much I have stated to Mr. Churchward and to representatives of the Q & C people, and no more. This is the substance of this matter so far as I am concerned. I dislike very much to be made a catspaw for either party.

C. R. NEHER, *Division Engineer.*

TO THE EDITOR OF THE RAILROAD GAZETTE:

You will please note that the statements in Mr. Neher's letter concerning the Servis tie plates are in substantial agreement with the report made by me to the Q & C Company, July 1, 1891, which was submitted to your examination, and upon which I predicated the conclusion stated in my communication of two weeks ago.

For a proper appreciation of the matter I will say that some two years ago I had become so forcibly impressed with observed performances of the Servis tie plate where railroads had substituted them for rail braces that I advised the making of careful tests in order to ascertain their theoretical value in preserving gauge on curves, etc.

A series of exhaustive tests, extending nearly a week were conducted by R. W. Hunt & Co., at the Illinois Steel Co.'s works in Joliet, Ill., the results of which showed a theoretical value far beyond my expectations which led me to make further personal examinations of plates so applied in order to secure data for a determination of the value of same in securely holding the rails and preserving the gauge on curves. This examination fully confirmed and even emphasized the conclusions which had been theoretically derived and I wrote a number of letters broadening our claims as to the value of the Servis tie plate in this regard.

It was at this stage that the report of the alleged Rochester accident reached us and I started the same day to thoroughly examine the matter. After full investigation I reported to the Q & C Company that the *abrasion*, not shearing, was only what could have been expected from the nature of the application, and in conclusion stated that I would in no measure abridge or modify the advanced claims which I had made. On the ten degree curve the abrasion, as admitted by Mr. Neher, was about the same as would occur with tough oak ties.

The punching for spike holes in the plate up to this time was wide and open, not having been designed for the severe applications which have been since recommended. Abrasion is the result of motion, the direct pressure without movement showing no effect on the spike. This led to a narrowing up of the spike holes so that spikes will engage the rail flanges without play, since which time the abrasion of spikes has been much less than would occur with ordinary oak ties, and in many cases has been eliminated entirely.

In hundreds of applications, particularly on the lines west of Pittsburgh, which has been more especially my field of operation, I know of no instance among the very few complaints ever received where investigation did not reveal a local cause for same, which was easily and satisfactorily corrected.

We could publish many letters of strong approval from strong men, but this controversy has certainly gone far enough and we much prefer to give reference to such as are interested in the matter.

BENJAMIN REECE, *Engr. Q & C Co.*

[Mr. Churchward's letter was submitted to Mr. Neher and to the Q & C Co. The replies are given above. The Q & C Co. informs us that Mr. Reece had reported to them the essential facts as to the abrasion of the spikes in the lead of the switch which Mr. Neher mentions, and had investigated and explained the local conditions which caused this abrasion. Indeed, we saw that report weeks ago. That company also informs us that it received an order for tie plates from the Western New York & Pennsylvania as late as July 26 last. This was for the wide plate, the narrow one, 3¼ in., having previously been used. It will be observed that Mr. Neher speaks of the "shearing" of spikes as

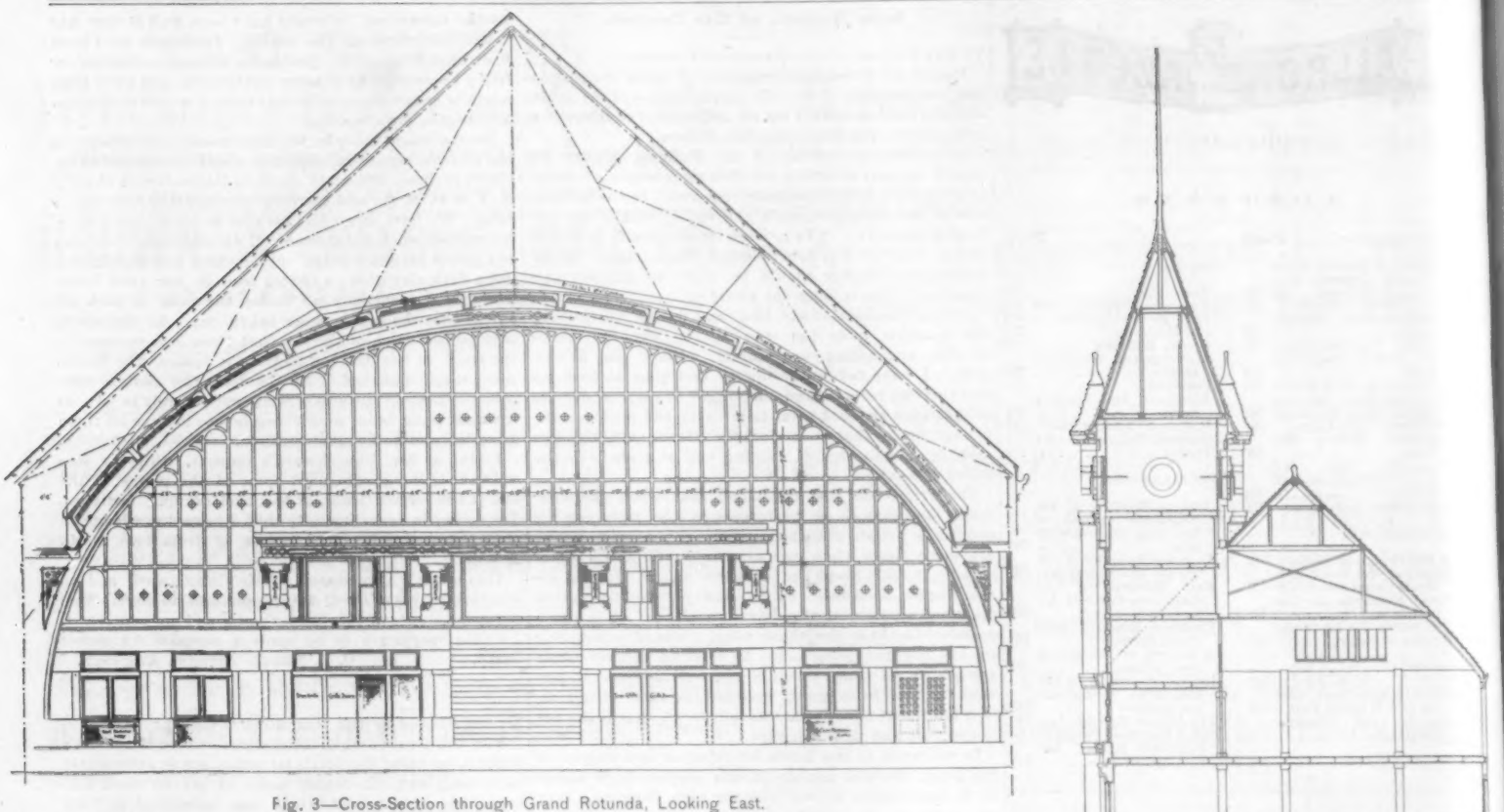


Fig. 3—Cross-Section through Grand Rotunda, Looking East.

having been a gradual process, taking place in from two to six months. We have no object in helping or in injuring the progress of any one tie plate, and therefore while we are glad to publish facts which will help engineers to arrive at a correct judgment, in this as in all other matters, we cannot permit our columns to be used as an arena for the conflicts of rival manufacturers, therefore this discussion now closes as far as the *Railroad Gazette* is concerned.—EDITOR RAILROAD GAZETTE.]

Central Station at Twelfth Street, Chicago, Illinois Central Railroad.

[WITH AN INSET.]

The present Central Station at the foot of Lake street, Chicago, which has been occupied so many years by the Illinois Central and Michigan Central Railroads, is at present the only large relic remaining of the great Chicago fire, the limestone of the walls still standing showing where their faces were melted away by the intense heat. The project of a new station has been often contemplated, and during the fall of 1891 a general ground plan was decided upon, and both the owning roads named several architects of Chicago, Boston and New York to prepare sketches for a new station. The plans submitted in this competition by Mr. Bradford L Gilbert, of New York, were adopted by both roads; but on account of the failure of the companies to agree on outside questions the whole scheme was finally abandoned, and the Illinois Central had to decide for itself upon a location elsewhere.

In the early spring of this year the location at Park Row, at the extreme south end of Lake Park, and running through to Twelfth street, was decided upon, and the entire problem was placed in the hands of Mr. Gilbert for solution, with the help of Mr. Wallace, Chief Engineer of the road.

A study of the general track plan (fig. 8), will show at a glance the difficulties to be overcome at this location. The location of the tracks, in the first place, was fixed by the yards beyond and the spur running out on the pier, the company owning but a small strip of land west of its right-of-way; consequently it was necessary to build an overhead structure, extending over eight tracks and containing the general rotunda and waiting rooms. It will be noticed that no two columns under this overhead structure could be placed on a straight line, north and south. In consequence of this the entire weight of the columns, heavy rotunda trusses and floor girders was necessarily carried on initial points, in some cases over 40 ft. apart, and in all cases at least 7 ft. from track centres. It would have been almost impossible to have carried the weight of this portion of the building on initial points and the office portion of the building on separate foundations without danger of uneven settlement, even if this plan had been thought desirable, so that the entire weight of the superstructure throughout the entire building, varying from 10 tons to 750 tons at various points, has been carried entirely on initial points, and no walls or foundations other than these exist.

To provide for these weights, and to avoid any settlement, one of the strongest and most substantial foundations ever constructed in Chicago has been made, over 2,000 piles having been used under the masonry footings sustaining the columns above. These piles in some cases are in clusters of 75 and carried down at an average depth below city datum of about 50 ft. Besides the difficulties encountered in driving piles through the "made" ground, the result of filling with débris from the fire, old bulkheads were encountered at the original lines of the lake breakwaters, as well as large amounts of rip-rap, and directly under the tower a spur of the eight foot water main from the new "four mile" pumping station in the lake, and which had to be bridged over below city datum line. All sorts of dé

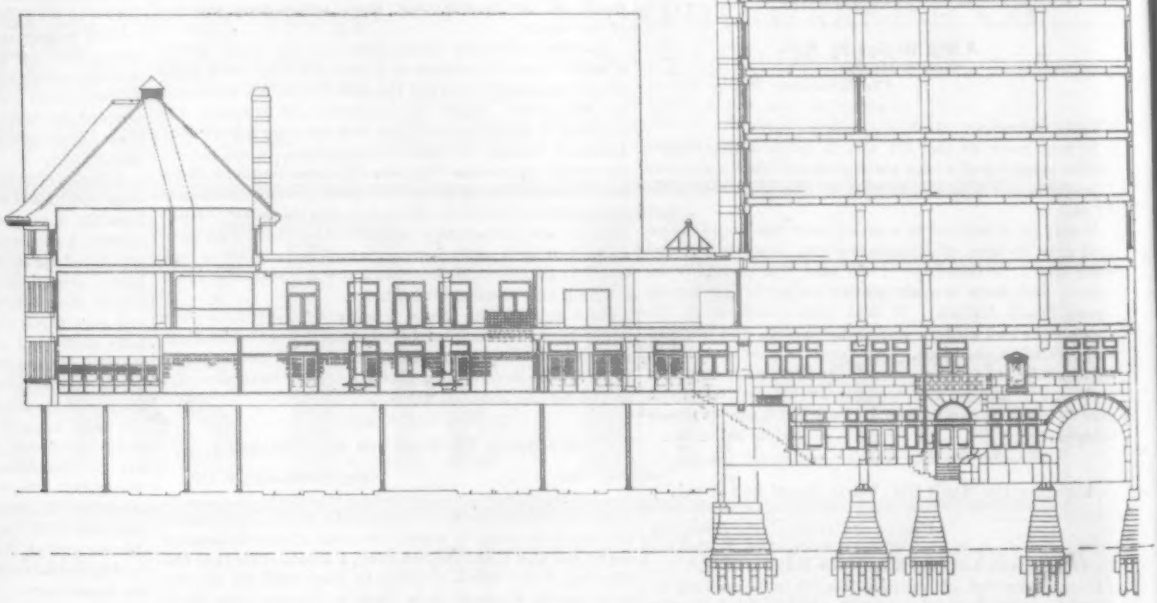


Fig. 4—Cross-Section through Women's Waiting-Room, Looking South.

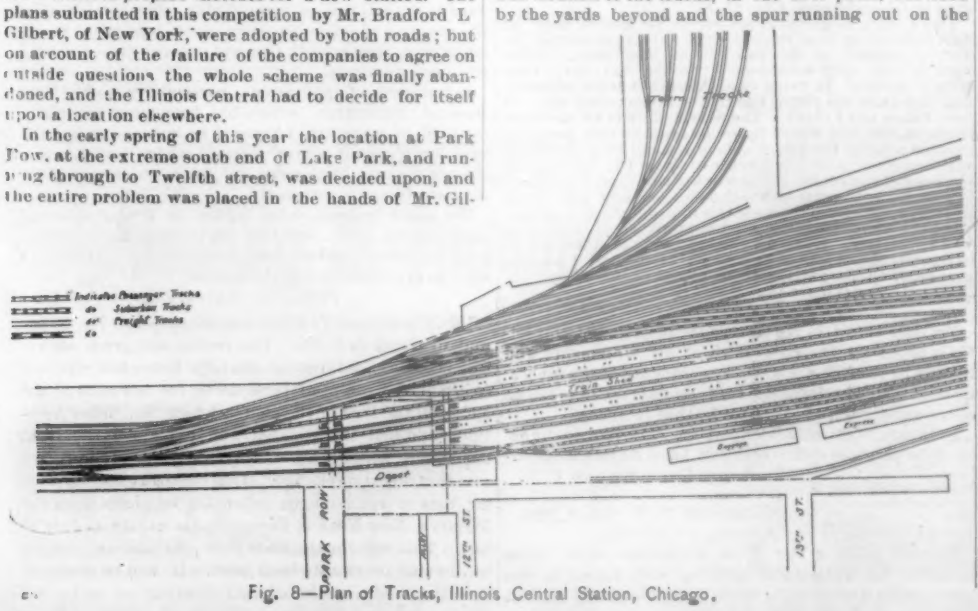


Fig. 8—Plan of Tracks, Illinois Central Station, Chicago.

bris was unearthed while excavating for the masonry piers supporting the columns, from old and antique copper and silver coins to a human skull. After the report on the test borings was received from Gen. Sooy Smith, the architect had a thoroughly competent and expert engineer, familiar with foundation work, make a personal examination of every building of considerable importance in Chicago, and make a written report upon the foundations used, the general character of the work, and the present condition of the buildings. Strange to say, it was found that very few piles had ever been used (excepting very short lengths which had proved of no practical service) with one exception, where the tower of one building had been constructed on long piles and had stood without appreciable settlement, although the other portion of the building had settled considerably. In cases where the usual "spread footings" had been utilized, with hardly an exception among the buildings examined, uneven settlements had occurred.

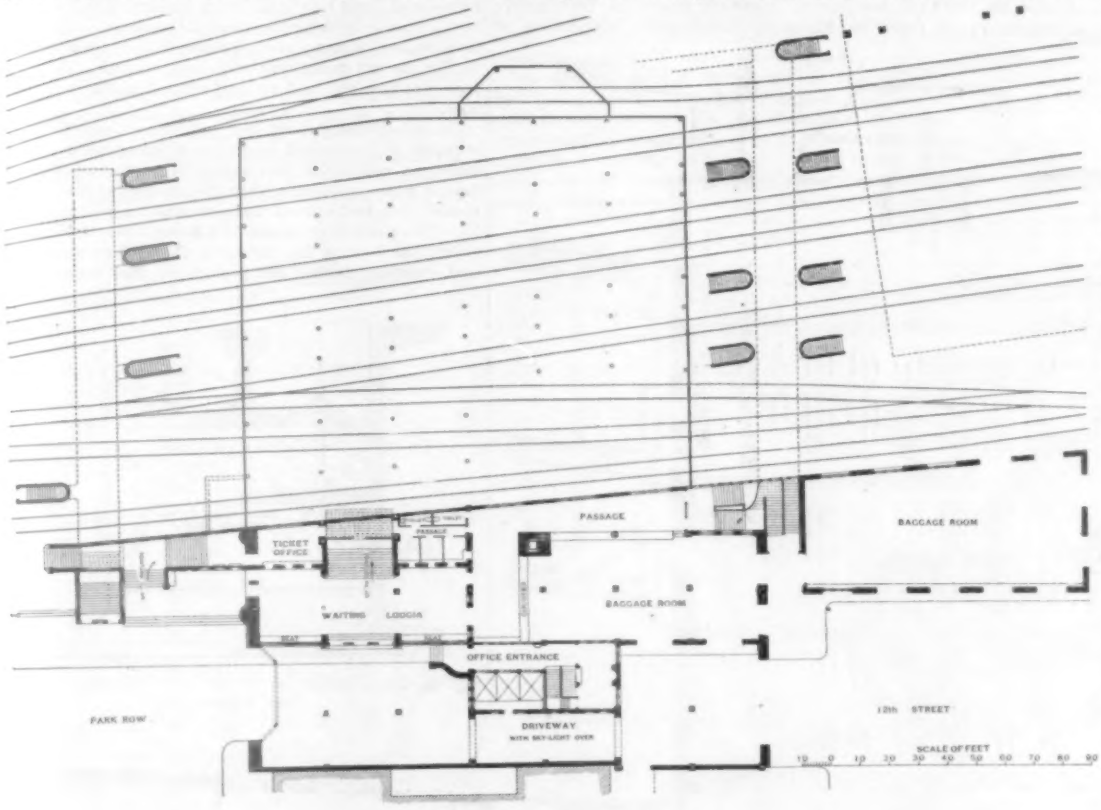


Fig. 1—Plan of Ground Floor.

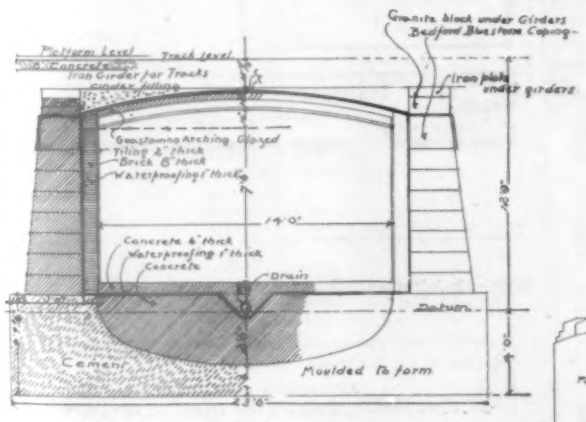


Fig. 5—Cross-Section of Subway.

A special feature in this station is the provision of two wide and light subways, to enable passengers to reach the streets from the platforms without the necessity of passing through the rotunda and waiting rooms overhead. Figs. 5 and 7 and also the general plan (fig. 1,) show these subways in detail. The one on the north, or Park Row side of the building, will also be utilized in connection with the suburban service. The present site at Lake street will be used eventually for suburban trains, and for these trains Twelfth street will be a way station. There will probably be platforms north of this station.

At the end of Park Row a very wide outside staircase of granite (as shown on the perspective sketch), is arranged for access to the waiting rooms, which are 17 ft. above the tracks. There is also a staircase in the carriage court or loggia, which is 25 ft. wide. Under this outside staircase at Park Row, with special ticket windows and staircases, a large suburban waiting room has been provided with separate entrances to the suburban platforms.

At the connection of the south subway with the main building, stairs have been provided for emigrant passengers. They lead either to Twelfth street or to the emigrant rooms over the baggage rooms, and also to the general rotunda, waiting rooms, and offices overhead, as shown on fig. 7.

The subways are finished on the sides with glazed tile 6×12 in. in light cream color, the backing being thoroughly protected by a water-proof seal from dampness or moisture. The arches of the subway are of patent glazed tile, arched and groined, while the floor will be of light marble mosaic, and the stairways to the platforms of the same material, excepting only the steps, which will be of granite. With good electric light, these subways will be free from most of the usual objections to such passageways. The tracks overhead are sunken and inside of an iron girder so as to make as few steps as possible necessary.

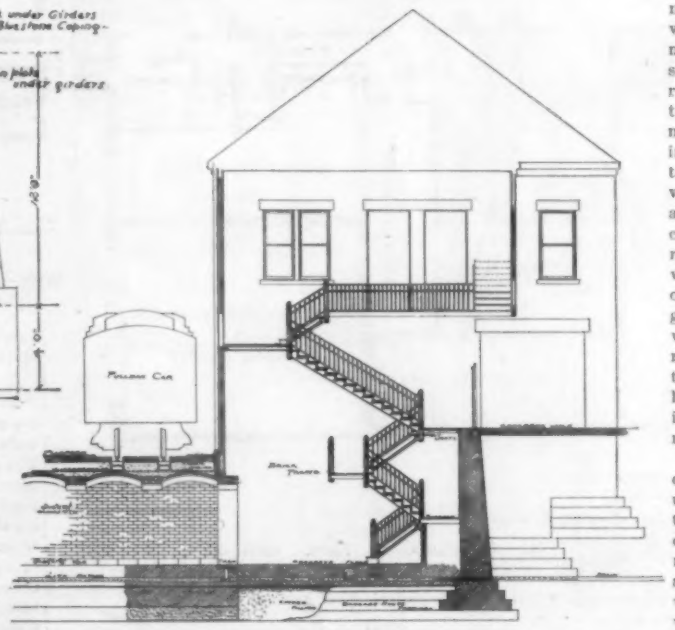


Fig. 7—Cross-Section, Showing Stairs Leading to West End of South Subway.

At the Park Row side of the building a carriage court and open loggia is provided about 80 ft. square, divided as shown on fig. 1, with 16 ft. driveway carried through to the baggage court on the Twelfth street end of the building. The side walls and partitions of this carriage court are of granite and light, speckled, buff Roman brick. Opening off the waiting loggia are the ticket offices, and the Pullman, Wagner and telegraph offices; also access to the baggage room for passengers who may desire to claim baggage. By this passage passengers can reach the train platforms without descending the stairs if they so desire.

Another feature of this general ground plan is the office entrance, which, although located in the centre of the building, will still form a most effective feature of the interior façade. Three rapid running elevators, also fireproof stairways, are provided to the upper eight stories of the office building, and also a waiting loggia on the ground floor in charge of a clerk, for persons who may desire to transact business with any of the officials. This loggia is provided with seats and an open fireplace, and made comfortable and convenient. Instead of going up to the various offices, messages can be transmitted through pneumatic tubes and answers received here. South of the general rotunda (as shown by dotted lines on fig. 1) is the trainshed, 135×600 ft. Under the office entrance and baggage room there is a large cellar containing the heating apparatus, elevator plant, and electrical plant for both incandescent and arc lights.

On the second story (as shown on fig. 2) are the waiting and administration rooms. The entrance loggia at the head of the stairs, about 50 ft. square, with floor and side walls of marble mosaic, is reached either from the carriage court or from the outside staircases already referred to. Opening from this loggia is the grand rotunda 100 ft. wide, 150 ft. long and 75 ft. high, domed, without a single column, but spanned by huge arches heavily ribbed with panels and groins forming the roof and making one of the largest waiting rooms in the country. The entire east end and the upper portion of the west end and south sides will be lighted through tinted glass. The floor of this room will be covered with marble as well as the side walls for a height of over 12 ft., in shades of red (as shown on cross section, fig. 3). Outside galleries and staircases from the rotunda are provided under cover to reach the train platform.

At the easterly end of the grand rotunda a bay window 25 ft. × 50 ft. is provided, over the parcel room and news stand, as a special outlook for passengers, giving a magnificent and unobstructed view of Lake Michigan through numerous plate glass windows, framed to represent pictures. The seats and divans are located as shown on fig. 2.

The women's waiting room, 50 ft. × 75 ft. (see fig. 4) will be paneled for nearly 10 ft. in height and finished in white enamel, with a floor of white marble mosaic. There is a generous smoking room opening off the grand rotunda and into the clear story of the carriage court. The toilet accommodations are spacious and first class in every detail; the floors and partitions of the rooms being of marble, while the very best sanitary fixtures are used, and forced ventilation secured. Over the women's waiting room, there is a large restaurant, as well as private dining rooms for officials and employés, reached by a gallery at the west end of the rotunda, with windows opening both on the north side of the building and into the clear story of the rotunda. The kitchen and store rooms are located in the top story of the turret at the northeast corner of the building.

As shown on fig. 4, the upper stories of the general office building will be used for the various departments, the entire structure being fire proof, constructed of steel and iron columns, rolled beams, terra cotta floor blocks and partitions. There are fire proof vaults on several floors. The halls will be of marble. All offices are light, well ventilated and arranged to meet theactual requirements of the different departments. The Chief Engineer's offices, on the top floor, are located where he has a view of all his draughting rooms. The upper stories of the tower are utilized for fireproof storage. The full height of the tower is 230 ft.

The exterior of the building (as shown on the perpective sketch) is erected for the first three stories of Milford (Mass.) pink granite, the archway at the Park Row entrance being 35 ft. wide, while the superstructure above is constructed of Roman speckled brick of the same color and shade, with terra cotta moldings to match. The roofs are made of brown vitrified corrugated roofing tile.

All metal exposed to view will be of copper, and the entire material and workmanship throughout is intended to be first class in every particular. The ground was first broken in June, 1891, the piling having been started the latter part of May, and it is expected to have the building ready for occupancy for railroad traffic by

the first week in May, 1893, in time for the Worlds' Columbian Exhibition. As has been estimated, the Illinois Central Railroad alone will, at that time, send out and receive 25,000 passengers an hour.

The cost of this building and trainshed, with the improvements in connection with them, will be upward of $1 000,000.

Annual Meeting of American Society of Railroad Superintendents.

The 21st meeting of this society was held at Hotel Brunswick, New York City, on Monday, Oct. 11. There were about 35 members present and the following delegates from other associations: From the Master Mechanics', John McKenzie; from the Master Car Builders', E. G. Grieves and R. C. Blackall; from the Roadmasters', W. H. Stearns; from the Train Dispatchers', I. H. McEwen. Other delegates had been appointed, but only these were present at the meeting. They were received by a cordial vote of welcome.

The report of the Executive Committee presented the following names for members of the standing committees for the ensuing year: Committee on roadway, J. B. Morford, H. B. Chesley (Boston & Albany), D. B. McCoy (New York Central); on machinery, John F. Divine, C. S. Davidson (N. Y., N. H. & H.), C. F. Spaulding (New London Northern); on transportation, F. K. Huger (E. T. V. & G.), C. S. Gadsden (Charleston & Savannah), L. T. Myers (Seaboard & Roanoke); on railroad signaling (this was made a permanent committee), J. J. Turner (P. C. C. & St. L.), C. H. Platt (N. Y., N. H. & H.), W. G. Watson (West Shore). The Executive Committee suggested that the ample fund of the society now warrants taking up the question of giving regular prizes for papers, and the establishment of permanent headquarters and a library. The report recommended that the constitution be amended so that any railroad man can be made an honorary member. This recommendation has to lie over a year. Finally it was recommended that the office of Treasurer, which has been well filled by Maj. R. M. Sully for several years, should receive a salary, and the by-laws were amended by the meeting to allow the Executive Committee to carry out this recommendation.

The Peoria Superintendents' Association sent in a communication stating that it has a rule allowing freight cars to be loaded to 4,000 lbs., beyond their marked capacity, and suggesting that this rule be made universal. (This subject came up in the meeting of the American Railway Association, elsewhere reported.) On application from the American International Association of Railroad Superintendents of Bridges and Buildings (a new organization of which the president is D. J. Travis Manhattan, Ia.), it was voted to tender to that association the same courtesies now accorded to the Master Car Builders', etc.

The election of officers for the ensuing year resulted as follows: President, H. Stanley Goodwin*; Vice-President, G. W. Beach; Second Vice-President, C. H. Platt; Members of Executive Committee, W. G. Wattson, C. D. Hammond; Secretary, C. A. Hammond,* Boston; Treasurer, R. M. Sully,* Petersburg, Va. (A star indicates re-election.)

The report of the Secretary showed a membership of 249, from 158 roads operating 121,462 miles. Over 50 of these members were elected at this meeting. The Secretary has collected from members $880; for advertising, $722; for annual dinner, $156; sale of publications, $6; total, $1,764. The expenses have been $1,228. The secretary suggested that the size of the society now demands more than a one-day session, and that the question of holding meetings at Chicago or Atlanta ought to be considered. In accordance with instructions he had sent out inquiries about the standard code of train rules, receiving, however, only 40 replies. The rules most criticised were numbers 20, 89, 90, 110, 509, 510, 511, 513 and 521.

The treasurer reported substantially the same figures as those given by the secretary, except that the amount on hand at the beginning of the year, $941, leaves the total now in his hands nearly $1,500.

The committee on roadway had no formal report, but presented a paper, prepared by Secretary Hammond, on tie plates, the substance of which was that the earlier forms tend to rot ties by allowing water to stand in the cavities made by the projections of the plates. The best tie plate is of heavy plate and made with a raised shoulder for the rail flange and with lugs beneath. This report was received and ordered printed in the proceedings.

The committee on machinery, which had been directed to report on compound locomotives, presented a list of questions concerning the merits of compounding, the tone of which indicated that the committee was unfavorably disposed toward the compound for general service. This committee presented a letter from the Morton Safety Car Heating Co., telling of the progress made by that company during the past year. The Morton system has been presented at previous meetings and described in the *Railroad Gazette*.

Fig. 6—Cross-Section of Girder for Supporting Track Over Subway.

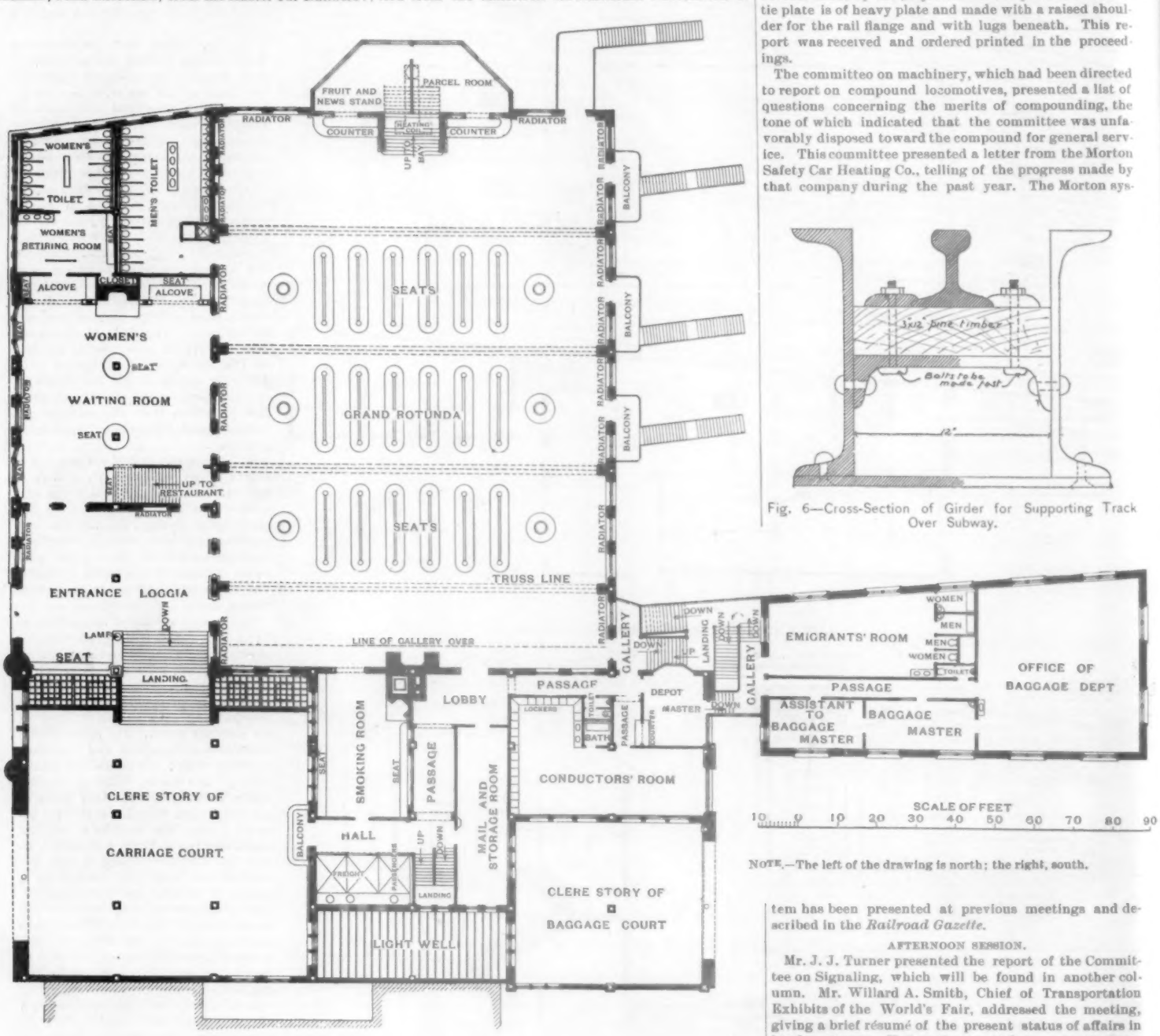


Fig. 2—Plan of Main Floor.

PASSENGER STATION OF THE ILLINOIS CENTRAL RAILROAD, AT PARK ROW AND TWELFTH STREET, CHICAGO.

Designed by Mr. BRADFORD L. GILBERT, *Architect, New York.*

NOTE.—The left of the drawing is north; the right, south.

AFTERNOON SESSION.

Mr. J. J. Turner presented the report of the Committee on Signaling, which will be found in another column. Mr. Willard A. Smith, Chief of Transportation Exhibits of the World's Fair, addressed the meeting, giving a brief résumé of the present status of affairs in his department. He has 18 acres of floor space, the largest single department on the grounds. The historical railroad exhibit will virtually be in the hands of the railroad companies, the exhibits of the Baltimore & Ohio, the Pennsylvania and the Vanderbilt systems being the main part of it. The Baltimore & Ohio exhibit will be of a general nature and by no means confined to that road. The company has sent men to Europe for data, and will build full size working locomotives to represent the more important types of earlier days. This and other features will make the railroad exhibit truly international. About 80 locomotives have already been entered, including a 100-ton engine. Complete signal exhibits will be made by English, French and German manufacturers. There will be at least three complete passenger trains from Europe. All the best English shipbuilders will exhibit large models of their latest vessels. Engineering societies in France and Germany will make important exhibits, the latter having 10,000 sq. ft. The brake companies of this country will exhibit brakes arranged in test frames as for 100-car trains.

Maj. F. K. Huger presented the report of the committee on transportation, consisting of a catechism for the general guidance of officers making examinations on the standard code, the preparation of this catechism having been directed by the last meeting. This catechism was read at length and elicited much interest. It

is of the same general nature as those used by the Erie, Chesapeake & Ohio and other roads, whose work in this line has been mentioned in the *Railroad Gazette*. Although we cannot make a careful comparison, our impression is that this one is rather better than any of those we have before seen. But the committee had not sufficient time at its disposal and presented this as a tentative affair. The task of making a catechism which should have no "leading questions" in it was, of course, a hard one, and it is admitted that much more work can be done in this respect.

The discussion on this report was the principal feature of the meeting. Major Huger learned from his circulars that only 60 per cent. of the members wanted a catechism at all, and he, himself, was prejudiced against the idea when he began his work. Mr. C. D. Hammond opposed the idea on the ground that men would get together, acquire superficial ideas enough to pass an examination, and then evade the requirement of thorough study. He ridiculed some of the questions as too simple, and calculated to detract from the dignity of an examination; every superintendent can get a true idea of the qualifications of his men without going through a long and formal list of questions. Those in favor of a catechism carried the day, however. It was shown that most of the objections to superficicial answers, prepared by the aid of a stolen copy of the questions, were based on the idea that written replies were to be made by the employé at his leisure. The examination of a trainman differs in important points from ordinary school examinations, wherein the examiner asks only a few out of several thousand possible questions. The committee did not aim to make a rigid form. The members of the committee and other speakers testified to the value to themselves of the work of preparing suitable questions on the standard rules, and Major Huger is now heartily in favor of a catechism. It will serve as a guide, preventing mistakes and omissions by the examiner and saving time. It was voted to adopt the report of the committee and print it, with the catechism, in the proceedings. A suggestion was made to print the catechism in a separate pamphlet, but it was not pressed as it ought to have been. A motion was finally carried to report the catechism to the train rule committee of the American Railway Association, suggesting it as an adjunct to the standard code.

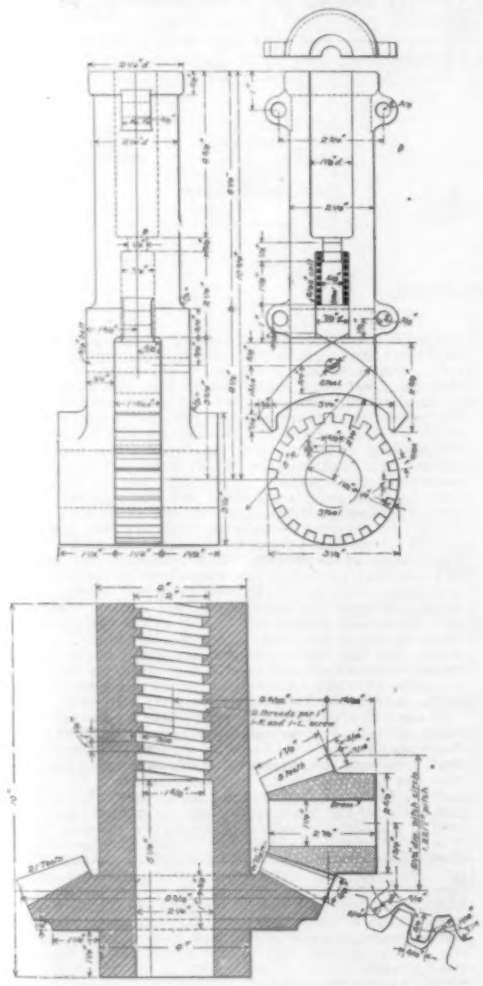
Secretary Hammond read a paper describing the protection of a drawbridge, which is printed elsewhere. Mr. W. L. Derr, Division Superintendent on the New York, Lake Erie & Western, read a paper entitled "Notes on the Block System," describing the systems in use on the Erie lines.

By this time it was six o'clock, and the question came up whether a second day's session should be held, a number of topics on the programme being still untouched; but the members, as usual, had come to New York largely for other business and for sight seeing, and it was therefore voted to adjourn without day. It was decided, however, to hold a meeting at Chicago next spring, which it is proposed to devote wholly to discussion. The dinner in the evening was successful and much enjoyed, though not quite so fully attended as that of last year.

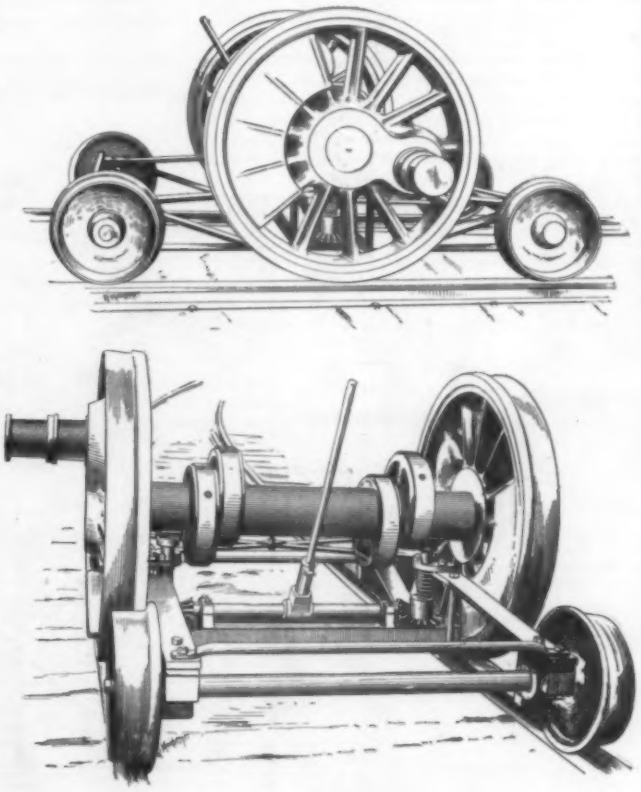
The "Handy" Truck.

A truck for handling locomotive driving wheels is shown in general from photographs and in detail from working drawings. It was built and is used in the Buffalo shops of the Western New York & Pennsylvania. A. Vail, General Master Mechanic. It is called there the "handy truck" and was designed primarily for handling locomotive drivers with plain tires. It is found very convenient where such wheels have to be moved any distance from the shop or engine house to the wheel latbe, on curved tracks. It is also found serviceable in handling drivers with a broken axle, and for setting tires, as the wheels have to be taken some distance from the shop for this latter purpose. The truck is not patented and can be used by any one, and it is so simple that the engravings sufficiently explain its mechanism.

In use the truck is run up to a pair of driving wheels, its frame is then lifted off one of its axles and slid under the axle of the drivers, or the drivers rolled over the truck frame, and then the frame is again replaced on its axle and the drivers raised clear of the truck by the ratchet and bevel gear shown. All this can be done in three or four minutes.



Details of Ratchet and Gear for the "Handy" Truck.



The "Handy" Driving Wheel Truck.

Uniform Rules for Working the Block System.*

I propose to-day to speak of matters of present interest to the members of the Association, relating to the standard code of train rules. Although its adoption called in many instances for a decided departure from established customs, the manifest advantage of uniform rules and the merits of the code itself have prevailed over all opposition. To-day it is referred to in our courts of law as embodying the best modern practice, and the railroad company that ignores it handicaps itself in any litigation involving the reasonableness of train rules, or a failure on the part of employés to observe them. These considerations induced the Association to establish the standing committee on train rules, to pass upon questions as to the proper construction and application of the standard code and upon suggestions as to its improvement.

. . . Such a code should be applicable to the train service of all roads operated under what may be called the American method, and should contain all rules necessary to the movement of trains with safety. These rules should be expressed as briefly as is compatible with a clear understanding of them, and the same word should invariably mean the same thing. In order that the code may meet the requirements of our largest railroad systems, and at the same time be used on single track roads with light traffic, those rules should be first laid down which are of primary importance and applicable to train service generally. To them should be added rules for operating double track roads and such others as may be required for operating roads with exceptionally heavy traffic. The primary rules, those that embody principles which under no conditions can be disregarded with safety, constitute the groundwork of the code to be accepted and followed by all; while the secondary rules, those which are required for the proper conduct of heavy traffic, are to be adopted by each of us as our increasing business may require them. This is the only basis on which a code of train rules for general use could be founded.

To the matter of expression much thought should be given. Every word fairly capable of more than one meaning should be defined in the sense in which it is intended to be used. . . . For the code to be of general and permanent value it must not be subjected to frequent alterations. Each employé should be so familiar with its very language as to be capable of reciting it from memory. The rules will then readily recur to his mind in an emergency. It is for this reason that once the language of the code has been so fixed as to be incapable of misinterpretation it should not be changed except to conform to accepted improvements in train service, and then only after careful consideration.

In one respect, however, the Standard Code is deficient. It does not recognize improved methods of train service [the block system] which have been in use for years on our best roads, and which are now deemed essential to the successful conduct of heavy traffic. The "Train Rules" so called are, by themselves, applicable only to the operation of a single track road with a light traffic. . . . I have not brought these matters up to disparage the Code. What has been accomplished in its preparation is of value to that large part of the mileage of this country which is single track, but the time has now come when the double track roads begin to call for recogniton by the Train Rule Committee and to ask for a standard set of rules for the protection of their trains by methods which do not depend solely upon the intelligence or vigilance of train employés.

This opens up a new and extensive field of action for the Committee, partly well explored and understood, partly a debatable ground. It is not surprising that the members of the Train Rule Committee, mindful of their past experience in formulating and defending the present code, should pause and reflect before entering upon the far more difficult task before them. It is no holiday work for the amusement of their leisure hours. It draws freely upon the time and brains of men who are already burdened with responsibilities of no ordinary character, and it is due to them that we should apprehend what it is that we have now asked them to do. It is to prepare a set of rules for the protection of trains by methods which do not depend solely upon the intelligence and vigilance of train employés. On double track roads those methods are intended to maintain safe intervals between following trains by the use of signals which serve to convey certain information to the engineers of those trains. . . .

The maintenance of space intervals is no novelty, for it has been for years in use upon many of our roads. The appreciation of its value has become so prevalent that its more general adoption is demanded, not only by the railroad journals, but also in the daily newspapers. Why, then, does not our Train Rule Committee add to the Standard Code "Rules for the movement of trains under the block system?" I do not propose to arraign these gentlemen before you to-day, but, being ex-officio a member of their committee, to offer without their knowledge an explanation in their behalf. They recog-

*Address of President H. S. Haines, at the meeting of the American Railway Association in New York City, Oct. 12.

nize the necessity for greater uniformity in the operation of trains under the block system; they acknowledge that the Standard Code should include a set of rules applicable to this system; they respect the call made upon them by the Association to furnish such a set of rules and would gladly respond to the call and yet they fail to do so. Being rather a looker on than an active participant in their deliberations, I have not only observed their situation, I have reflected upon it. My conclusion is that their inaction, if I may so term it, is due neither to their inability nor to their indisposition to codify the ordinary practice in the use of the block system, but because they are in doubt as to the sufficiency of that ordinary practice to provide for the normal increase of train service on the roads where these rules are more anxiously desired, and because of the impending changes in the conditions under which the service is to be performed.

. . . The fundamental principle of the block system was that the engineer of a train approaching a signal station was to be informed from that station whether there was or was not a train in the block ahead of him. The next step was to instruct that engineer as to the use he was to make of that information. There was no doubt as to the rule which he was to follow when the block was clear—he was to proceed. But what was he to do when he was informed that the preceding train was still in the block? Was he to go ahead or not? The safest rule was to stop until the block was cleared. But just as increasing traffic became embarrassed by the time interval, so the same experience followed the institution of the space interval and this embarrassment it was sought to remove by such a modification of the rule to stop until the block was cleared as permitted the following train to enter the block with the knowledge that it was not clear. This is the broad distinction between the absolute and the permissive block system. The former is not only safe but simple; the latter requires that the rear of the first train in a block must be protected by flagmen with due regard to the relative speed of the two trains, to the curves and gradients of the track and to the distance in which the following train can be stopped. I think, therefore, that it is fair to say that the permissive block system is an improvement on the time interval only in this respect: that the engineer of the approaching train can be informed whether there is or is not a train in the block ahead.

I say that he can be informed, but it is possible that he may not be informed and, as a matter of fact, sometimes he is misinformed. This brings us to consider the manner in which this information is conveyed from the operator to the approaching engineer. . . . Whatever differences of opinion there may be among experts as to the adoption of the absolute or the permissive block system, they ought to make an effort to reconcile their differences so far as to unite in recommending a uniform system of signals for conveying information to the engineer of an approaching train. The causes for their different opinions are all well founded, but they are not irreconcilable. It is true that they have become more involved of late through the introduction of interlocking switch plants, as I will mention later; but what I wish to impress upon you is that, in the operation of the block system, a code of rules for the guidance of trainmen is one thing and a code of signals for conveying information to them is another, and that neither should be confounded with the appliances for operating these signals.

For the better understanding of my views as to the duty of the Train Rule Committee in this matter I will repeat that there are three separate subjects connected with the operation of trains under the block system:

First, The rules for the guidance of trainmen.

Second, The signals which are to convey information to them.

Third, The appliances for operating the signals.

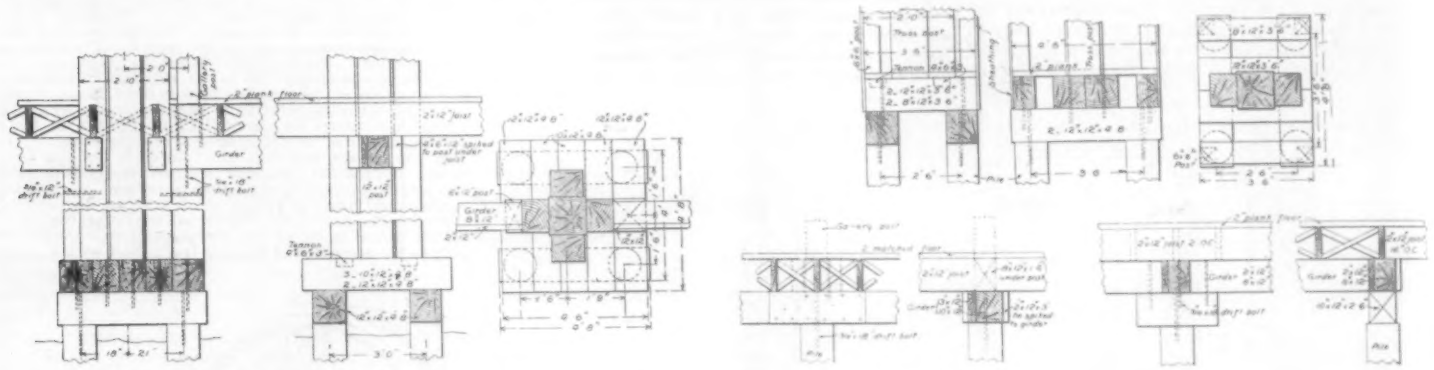
The mention of the third subject brings up a matter which, by the rules of our Association, has been specially committed to the Standing Committee on Safety Appliances, to consider and report upon all questions affecting the essential requisites of devices for interlocking switches and for block systems; the other two subjects being properly within the purview of the standing Committee on Train Rules. As the three subjects are somewhat interdependent, your Executive Committee has requested that the two committees shall jointly consider them.

The information that the block is clear or not clear is conveyed to the engineer through human agency, and the possibility of error is doubled, or rather tripled, by the intervention of two persons besides the engineer. He may either misinterpret or disregard the visible signals; the receiving operator may misinterpret or disregard the information which is to control the display of the signals; the sending operator may either transmit that information incorrectly or fail to send it at all. . . . The block system does not eliminate the element of human fallibility. This defect railroad managers, signal manufacturers and inventors are trying to remedy, and it is because our Train Rule Committee is conscious of these facts that it has hesitated to indorse the block system as now used. Their hesitation has been increased by the contest between the several systems which have been devised to supplant the present system, and which are now in experimental use to an extent which promises to simplify the solution of the problem by an exclusion of that which has failed in trial. The effort to eliminate human agency begins with the normal state of the signal, whether the action of the operator at that point shall be required to inform the approaching engineer that the block is clear or that it is not. If he can only give this information under the control of the operator at the outlet of the block there is one mind the less to make a mistake. It is for the Train Rule Committee to so determine the normal state of the signal as to reduce the probability of its being misinterpreted or disregarded by the approaching engineer, and for the Safety Appliance Committee to determine the essential requisites of the appliances which shall prevent the receiving operator from displaying a signal improperly. Going to the other end of the block, we have to guard against the transmission of incorrect information to the receiving operator or the failure to send it at all. The latter contingency may be avoided if the normal state of the entrance signal can be changed only by the act of the sending operator, but the former, the protection, against the transmission of incorrect information, is more difficult to secure. This man has to determine that the block is or is not clear, and then control accordingly the display of the signal at the other end of the block. He determines that the block is clear, first, from a notification that a train has entered, next by actual observation of its passage. It is not sufficient for him to know that an engine has passed out of the block, but also that every car which was attached to that engine when it entered the block passed out with it. That some such protection should be required by the rules is within the province of the Train Rule Committee. . . . . Admitting that the operator at the outlet of the block is correctly informed that the block is clear, we have next to insure that this information is correctly transmitted to the entrance and the signal properly displayed.

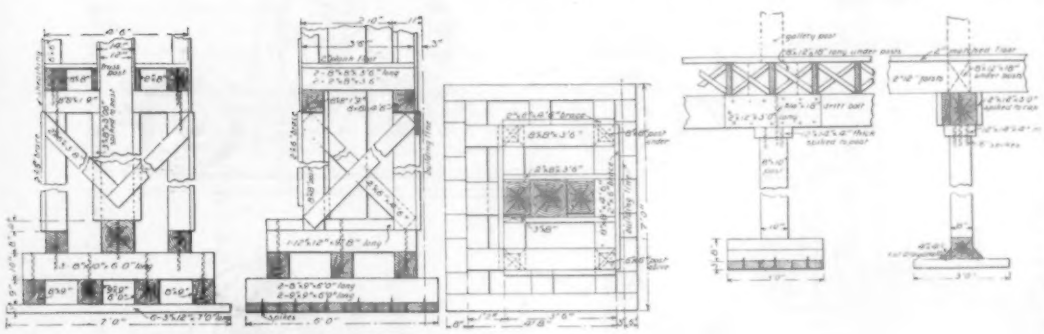
If the rules, signals and appliances for the use of the block system can be successfully wrought out to this stage then there is yet another step to be taken, which shall eliminate the intervention of the sending operator. This has been experimentally accomplished by several devices actuated by the train as it passes the entrance and outlet of the block, simultaneously operating a display of the signals required to block the interval which it is entering and to clear that which it is leaving; in deed, this effect can now be extended to the next block behind it, so that the engineer of a following train is thereby informed, not only as to the condition of the block ahead of him, but also as to the condition of the block ahead of that. To avoid retardation of the train, the entrance or home signal has been supplemented by the distant signal, and in the system above described the entrance signal of one block is [on the same post with] the distant signal of the block next ahead.

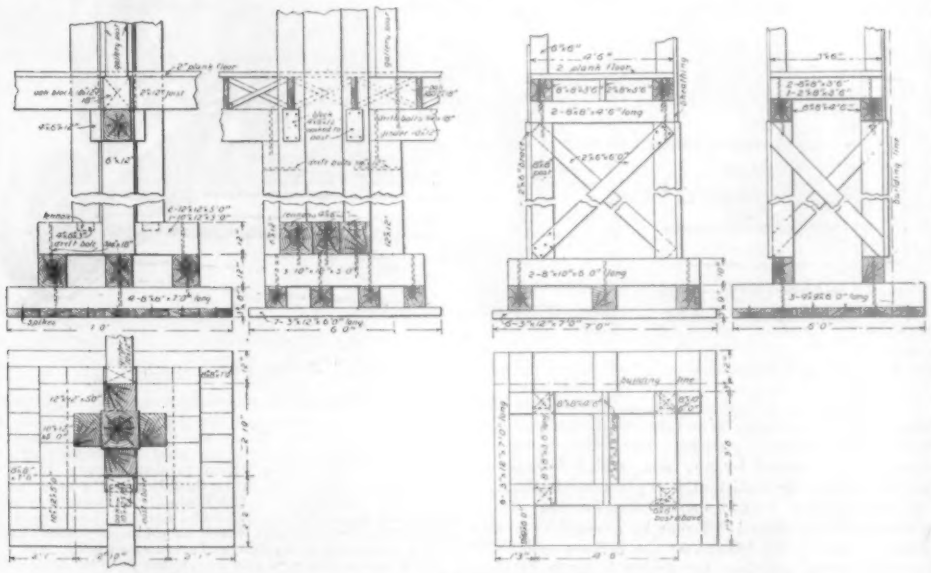
Here we seem to have reached the ultimate limit of the resources at present available for the protection of trains against each other, outside of the efforts of the trainmen themselves. There is another step which may yet be taken, that of protecting the trains against the misconduct or neglect of these very train men, by the introduction of appliances connected with the block signals which shall strike the engine gong or blow the whistle, or apply the brakes, or even close the throttle valve of the approaching train, but these appliances have not reached such a stage of efficiency as to call for further notice in this connection.

Proceeding on a line parallel with the improvement of the block system, there has been a demand for greater security against derailment or collisions from misplaced drawbridges or switches or at railroad crossings, and interlocking plants, developed into marvelously ingenious pieces of mechanism, have involved the same questions as to rules, as to signals and as to transmitting information to trainmen and to operators that have followed upon the development of the block system, and, as a consequence, there has come about a complication which our Train Rule Committee cannot disregard. On a few of our trunk lines a still further complication has arisen which will extend with increasing traffic. This is occasioned by the construction of additional running tracks, so that the train rules and signals are required to provide for running trains on more than two tracks. While this is not a pressing want just now, it may well be provided for in a code of standard rules for a block system in order to insure consistency with that code in the further development of such service. . . . I will not refer at greater length to the task now before our joint committee on Train Rules and Safety Appliances, and hope that what I have said in explanation of the difficulties which they have encountered will be sufficient to justify their tardiness, and in some measure to indicate the course which they must pursue. In your criticisms upon their reports, and in your anticipations of the result of their work, you should be restricted by the same considerations which control them, viz.: that our Association undertakes no more than to establish the best modern practice as recognized by the majority



CHARACTERISTIC PILE FOUNDATIONS—WORLD'S FAIR BUILDINGS.





CHARACTERISTIC SPREAD FOUNDATIONS—WORLD'S FAIR BUILDINGS.

of our members and only in those matters in which a uniform practice is essential to the best results. One of these problems is the development of a standard code of train rules, and this problem can only be said to have been definitely solved when trains can be run frequently, at high speed, from start to finish, without time card or train order, secure against derailment or collision and controlled only by the block signal.

The Croton Aqueduct Dam.

After nearly ten years of agitation and discussion, the final and essential features of the plans for the new water supply of New York from the Croton River have been approved and the work has been put under construction. The contract for the storage reservoir dam at the intake of the new aqueduct has been awarded to James S. Coleman & Co., the lowest bidders for the work, the cost of which, as estimated by the engineeers, was to be $4 574,820, and as proposed to be built by the contractor is $4,150,573.

The violent opposition which was made to the construction of this work at all and which has been the cause of the great delay in beginning the work, which ought to have been begun simultaneously with the construction of the aqueduct itself, has been, in some respects, probably of benefit to the city, and certainly has been the occasion of a more thorough elucidation and illustration of the principles governing the construction of great masonry dams than could otherwise have been obtained. Nearly every engineer of any prominence in hydraulic work and masonry construction has had his say; some through official reports called for by the authorities in charge of the Croton Aqueduct, some retained by the opponents of the Commissioners' plans, and a not inconsiderable number of volunteers, several of whom propounded theories as extraordinary as they were novel.

In one respect the opposition and delay have been disadvantageous in that they have caused the location of the great dam to be changed from the original site at Quaker Bridge, suggested by Mr. B. S. Church, the originator, as it is believed, of the aqueduct scheme, and for some years the Chief Engineer of the Aqueduct Commission. The very name "Quaker Bridge Dam" had become so odious to the opponents of the project that it was deemed advisable to dispense with it entirely and go further up stream to a point in many respects less advantagous for the purposes of the storage reservoir which was needed and for the construction of a dam, but which, nevertheless, gave opportunity for the creation of a sufficiently capacious reservoir and for the construction of a dam of somewhat less cost. This site, selected after careful examination by Mr. Alphonse Fteley, the Chief Engineer of the Aqueduct Commission, is known as the "Cornell Site."

The dam to be built here will unquestionably be an imposing structure in appearance. Viewed from below, there will be seen on the right bank of the river an earthen embankment 500 ft. in length, extending from the hillside to a point where it is about 100 ft. high. Continuing straight across the valley, there will then be a masonry wall 600 ft. long and of a general height of 150 ft. above the valley. From the end of this wall and extending down stream nearly at right angles to the line of the dam there will be a wall of masonry 1,000 ft. long and from 150 ft. to 5 ft. in height, the face of the wall being built in steps, and over this wall the waste water from the reservoir, when filled to overflowing, will fall in a foaming cascade.

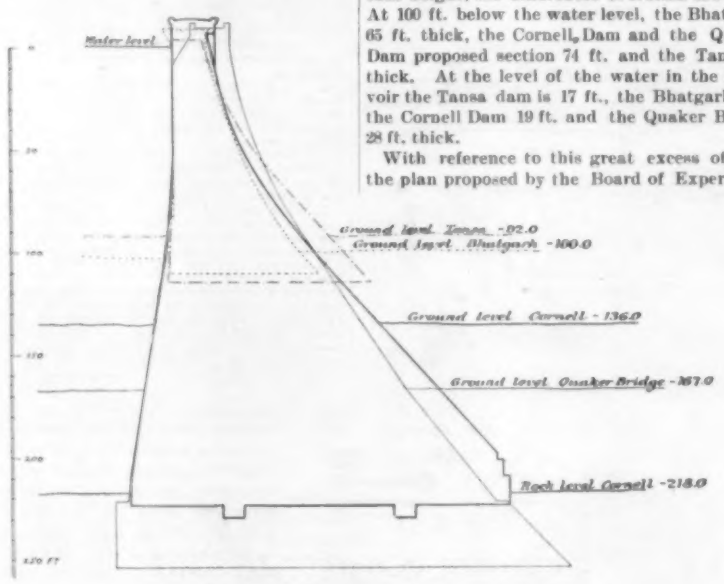
Æsthetically this dam will not be a great success. The long spillway on the left will doubtless present a very eautiful appearance when the water is flowing over it, which will be for perhaps a few weeks in the course of the year, but the combination of masonry and earth, and the general rectangular lay-out of the whole concern will have more of the characteristics of a mill-dam than of a great engineering structure.

As regards the most important feature of the work, the section of this masonry wall, which from the top of the rock at the bed of the stream will be about 225 ft. high, and will have to sustain the pressure of 167 ft. of water, it is interesting to compare the final results reached by the Chief Engineer with those of other engineers who have given attention to the subject of masonry dams.

It is hardly worth while to examine all the various plans which have been suggested for this dam, nor the plans of dams which have been built for several years. It will suffice to compare the section of the Cornell Dam with the sections of three others, as shown on the accompanying diagram. Two of these dams have recently been constructed in India by English engineers, and are only about half the height of the Cornell dam. The third section illustrated is the one which was suggested for the Quaker Bridge dam by Messrs. Davis, Croes and Shunk, the Board of Experts appointed by the Aqueduct Commission in 1888 to consider the question.

For the first hundred feet in depth below the water level, which is as far as these four sections can be properly compared, as two of them extend but little beyond that height, the differences of section are very marked. At 100 ft. below the water level, the Bhatgarh Dam is 65 ft. thick, the Cornell Dam and the Quaker Bridge Dam proposed section 74 ft. and the Tansa Dam 87 ft. thick. At the level of the water in the Croton reservoir the Tansa dam is 17 ft., the Bhatgarh Dam 15 ft., the Cornell Dam 19 ft. and the Quaker Bridge section 28 ft. thick.

With reference to this great excess of thickness in the plan proposed by the Board of Experts, it appears to have been caused by the introduction into the calculations of the question of pressure exerted by ice forming on the surface of the reservoir. In the Indian dams, of course, no such question had to be considered. The final conclusions of the Chief Engineer of the Croton Aqueduct appear to have been that the question of ice pressure was not worthy of consideration, and consequently the dam is to be built with a thickness at the ordinary water level of only two-thirds of that recommended by the Board of Experts in 1888. At 200 ft. below the ordinary level of the water the Cornell Dam is 180 ft. in thickness, as against 160 ft. recommended by the Board of Experts.



The Intake Dam of the Croton Aqueduct, at the Cornell Site.

NOTE.—The heavy lines show the Cornell dam of 1892; the light lines show the Quaker Bridge dam as designed by the Board of Experts in 1888; the dotted lines show the Bhatgarh dam, India, 1891; the dot and dash lines show the Tansa dam, India, 1891.

The sectional area of the two plans for the 200 ft. in height does not differ materially. The difference lies in the distribution of the material—the Board of Experts preferring to place the maximum resistance to extraordinary forces at the top of the dam and the Chief Engineer putting them at the bottom.

As regards the horizontal plan, the straight line adopted by the Chief Engineer is undoubtedly the cheapest in construction, but it probably will not satisfy the extreme theorists on either side, one set holding that an arch curving up stream is the best as affording some slight possibility of arch action, and another set claiming that the toe pressures and liability to overturning would be diminished by having the concave side of the arch opposed to the water. It is not impossible, too, that the general public may agree in opinion with an old Putnam County farmer who laid down the maxim that an arch ought to be built curving up stream, so as to "throw the heft of the water agin the hills."

However that may be, New York is now sure of having its great water supply scheme from the Croton completed in its entirety by a structure which will be a credit both to its designers and to the city.

Characteristic Foundations for World's Fair Buildings.

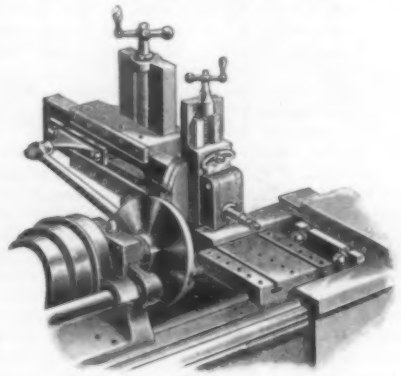
We illustrate herewith what may be termed typical foundations which have been used in the construction of buildings for the World's Columbian Exposition. Before beginning construction the supporting power of the grounds was tested by loading platforms with pig iron to the weight of 1½ tons to the square foot and by boring, driving piles, etc. It was found for a large part of the ground that the sand was sufficiently unyielding to support the proposed loads without resorting to piling. In these cases the spread foundations as illustrated by four of the accompanying cuts have been used. It will be seen that these consist of a platform of 3-in. planks laid on the sand and a crib work of timbers built on this, the amount of timber framing varying in accordance with the load which would come on each foundation.

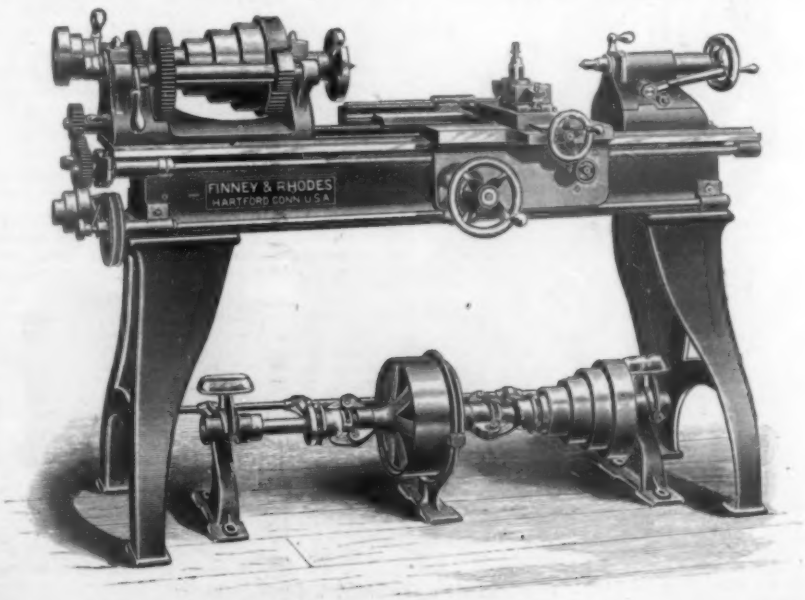
The remaining cuts show corresponding examples of pile foundations. The piles were driven from 12 to 20 ft., depending upon the character of the soil, and there are four piles to each of the principal foundation piers.

It was not found necessary to use any piling for some of the buildings, but for others, as, for example, the Manufactures and Liberal Arts Building, both pile and spread foundations were used.

A New 14-in. Gibb Lathe.

The 14-in. Gibb lathe, illustrated, has been lately brought out by Messrs. Finney & Rhodes, of Hartford, Conn. Some of the special features are briefly described.





New 14-in. Gibb Lathe.

Power gearing is brought to the front of the head-block instead of the rear as is usual. By doing so the power is applied to the spindle downward and against the lifting tendency of the tool in the tool post, thereby reducing the inclination to chatter. Contrary to the impression that a lathe geared in this manner would be in the way of the operator, inspection shows that it is not, and being amply protected by a shield over the gearing at the face end of spindle, it makes a clean lathe to work with as no oil or dirt can fly from the gearing or rub off.

The feed mechanism is conveyed by small cone pulleys of three steps connecting with groove pulleys carrying straight and cross belts to the feed rod and is entirely independent of the screw and rocker gears which are only used for screw cutting. This feature will commend itself, as the constant use of the rocker gearing for turning soon wears them so that they are unfit for good screw cutting. The worm of the feed rod runs in a reservoir of oil. The tool holder has the range and action of a weighted lathe carriage and by the turn of a screw is clamped as though it were one solid piece and no pressure or vibration can loosen or disturb it when either at its highest or lowest adjustment.

The cross feed screw in the carriage is entirely covered, passing through the centre of the lathe carriage in a direct line to the centre of the taper attachment, to which it is connected by a sleeve. At the back of the lathe bed there is cast solid with it a shelf nearly the full length of bed, on which is swiveled the taper bar, the slide of which is fastened to the sleeve of the cross feed screw in such a manner that the pull and resistance are all in a straight line. When the taper bar is set at its greatest range, which is about two inches to the foot, in moving the lathe carriage by hand the resistance is barely felt by the operator.

A shaper attachment designed for this lathe is a novelty, and is made to fasten to the table on which is the taper bar. It receives its motion from a special face plate. It has a stroke of 8 in. or less as wanted, thereby increasing the utility of the lathe, especially in small shops or experimental rooms, combining a lathe and shaper in one tool. It can be attached ready for work in less than five minutes.

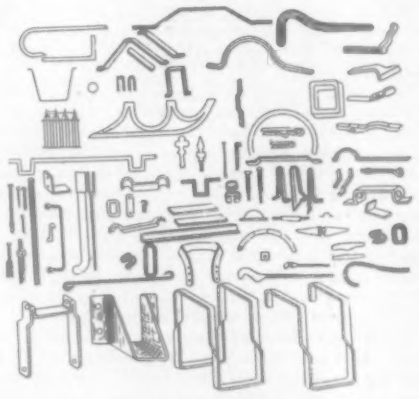
Another special feature is the single belt reversible countershaft, built for this lathe and of novel construction. By the use of this counter not only is space on the main line of shafting economized, but also the expense of belting and pulleys avoided. A lathe is much easier located if but one pulley is to be placed on the main line of shafting, especially in a crowded shop with interfering counters, than if spaces for two pulleys were necessary, as would be required with the common two-belted countershaft.

The Hercules Bending and Forging Machine.

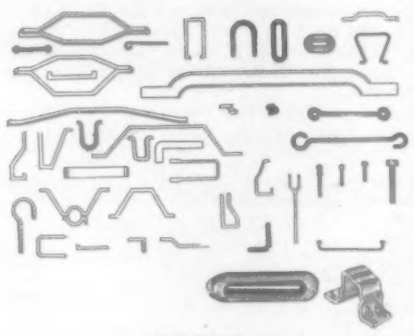
We illustrate one of the latest forms of a type of machine which has revolutionized the manufacture of forgings for many purposes and especially in car construction. The great variety of work which can be accomplished more rapidly and cheaply with such a machine than can be done by hand forging is well illustrated by the engravings showing different forms which have been made on the Hercules machine.

The special features claimed for this machine are, that the cost of dies is greatly reduced by means of a new method of attachment so that the cost of furnishing the ordinary class of dies is about one-half what it has been heretofore; the use of back screws which have been the source of annoyance in other machines by becoming upset or otherwise damaged when subjected to heavy loads has been entirely done away with; the fault of the dies lifting when the dead point of the crank is reached is avoided by placing the die much further below the centre of the main shaft than has been done in other machines; a steel wrist pin is used which is nearly as heavy as the cast iron pin formerly used.

The Hercules Iron Works also build at their shops in Aurora, Ill., a double end forging machine and are prepared to furnish a large variety of dies. Some of the latter which are of special interest are the arch bar die in which the whole power of the machine is brought to bear upon the corners of the bar where the bending is done; a transom die for turning over the ends of transoms; a freight car hanger die for upsetting the hanger after it is bent, and a turn-buckle die for making turn buckles from 1¼ in. up.

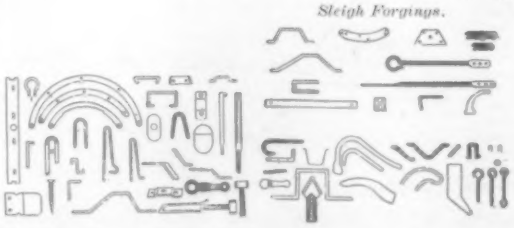


Miscellaneous.



Car Forgings.

Sleigh Forgings.



Wagon Forgings. *Implement Forgings.*

Specimens of Work by the Hercules Forging Machine.

Fall Meeting of the American Railway Association.

The semi-annual meeting of the above named association was held in New York on Wednesday of this week, about 60 representatives being present. The first business was the address of President Haines, which will be found in another column. The Boston & Maine and the Concord & Montreal have joined the Association, and it now includes companies operating 127,000 miles of road. November 13 was fixed as the date for the general change in time tables.

The report of the committee on car service which was made at the March meeting was then taken up. The per diem question, that is, the subject of settlement for interchanged freight cars, was not acted upon, but the rules to prevent the misuse and diversion of freight cars, proposed in March, were adopted, to be put into effect on January 1 next. These rules are as follows:

RULES TO PREVENT THE MISUSE AND DIVERSION OF FREIGHT CARS.

1. Foreign cars must not be used in local service, except to load in the direction of home. It shall, however, be permissible to send them in an opposite direction to secure a homeward load.
2. Foreign cars received loaded may be returned to the road from which they were received, or they may be used for shipments destined to points on the line to which they belong via another route, in case said shipments cannot be routed via the line delivering the cars, provided, however, the delivering line makes no demand for the return of the cars to it.
3. When the delivering line desires the return of certain foreign cars to it, it must make requests upon the receiving line for same, and if this request is received in time it must be complied with.
4. A diversion of a car is hereby defined as meaning the loading of a foreign car to a point on a road to which it does not belong, or via a line from which it was not received. But it will not, however, be considered a diversion to load a foreign car to an intermediate point on its legitimate route home, or to a point on a road to which it does not belong, provided it passes over the road owning it to reach its destination.
5. Any road diverting a foreign car will be required to pay to the owners of said car a penalty of $1 for each and every diversion.
6. If a foreign car is loaded locally and upon arrival at destination the shipment is reconsigned, if the reconsignment would cause a diversion of the car it must be transferred under the rules governing transfers, where this can be done witout injury to its contents, and the car returned to the road from which it was received or to the owners. But in case the shipment is of such a character that it cannot be transferred, the car may be run through to destination and the same will not be considered a diversion.
7. When empty foreign cars are delivered by one line to a connection on requisition of the latter, for return loading via the road making the delivery, they must be so loaded and returned, otherwise they shall be treated as diverted cars.
8. Foreign cars may be loaded with transferable commodities consigned to any road at a junction point common with the road that owns the cars, and on arrival at such common junction point contents will be transferred, and the car returned to delivering road or to owners, at the option of the road transferring the cars. If cars, loaded as above mentioned, are not transferred, the line responsible for making transfer will be liable for diverting the cars except as provided in Rule 6.

The train rule committee made a report stating that its most important business had been necessarily postponed because the members of the committee could not get together, but it suggested the following changes in the standard code, which were agreed to: Rule 81, omit the word "special;" Rule 95, last line, read "the right of track over it, have arrived or left;" in Form G (train orders) and the notes and examples under it, the word "extra" is substituted for the word "special;" Form J is made to read "Hold.... at.....," and the first example reads "Hold No. 2 at Berlin."

The Committee on Safety Appliances reported that it would shortly issue a circular to members asking for information on the subject of automatic couplers and power brakes up to Oct. 1. The subject of Interlocking and Block Signals has been under consideration at several sessions of the committee, but at present the committee can only report progress. There have been several conferences with the Committee on Train Rules, however, and it is hoped to bring about satisfactory results "in due time."

The committee on car service reported that it had sent out circulars to learn the prevailing practice regarding the loading of cars in excess of their marked capacity. Thirty-two per cent. of the 140 roads replying, operating 30 per cent. of the mileage and owning 40 per cent. of the equipment, allow 4,000 lbs., and the committee recommended that this be made the rule of the Association. This recommendation was adopted, together with the following, also reported by the same committee:

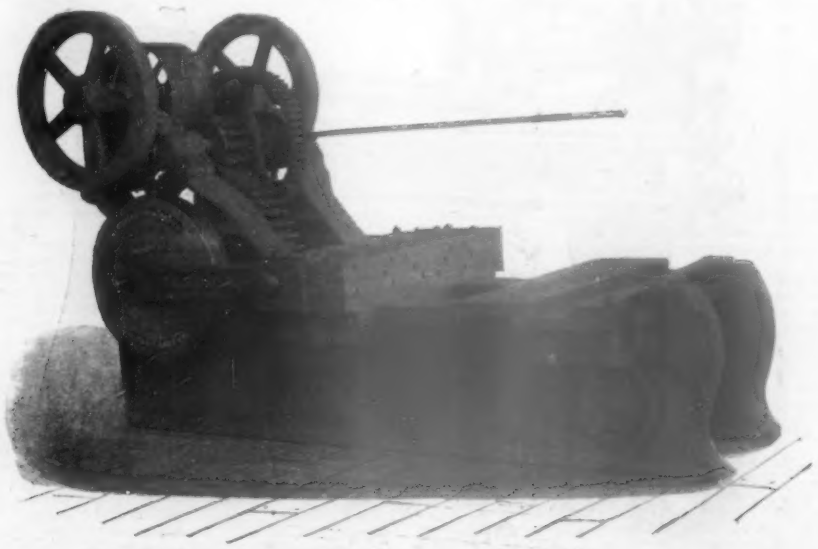
Whereas, The Association at its last meeting adopted a recommendation of the Committee on Safety Appliances that all cars on freight trains should be equipped with power brakes; and

Whereas, It is especially important that all cars used for the transportation of live stock, dressed beef, fruit and other perishable freight requiring high speed should be equipped with the best possible appliances, this Committee would therefore respectfully recommend to the Association the adoption of the following resolution:

Resolved, That this Association recommends to all its members that all cars used in the transportation of freight requiring high speed should be equipped with power brakes without delay, and also would urge that this matter be brought to the attention of the owners of such cars by the several roads using them.

The rule in reference to the use of the tracks of other roads in case of wash-out, etc., was amended by the addition of the following clause: "In case the engine and crew are furnished by the line whose track is used the charge shall be $1 per train mile, with no charge for fuel, water and engine supplies."

The next meeting of the Association is to be held at Chicago. The members of the committee whose terms had expired were re-elected, except that the Old Colony was substituted for the Fitchburg on the Committee on Safety Appliances.



The Hercules Forging and Bending Machine.

The Price Rail Joints.

The various rail joints illustrated in this article are recent inventions of Mr. James M. Price, of Philadelphia, Pa. The Double Girder Joint consists of two plates of malleable iron or cast steel, with feet seated upon each tie, and their top without contact with the head of the rails, except about 3 in. at the middle of the joint.

Strength is added to these plates by two circular or elliptical arches placed between the ties, with an inverted arch so shallow as to only slightly displace the ballast at the centre. From arch to arch strong ribs pass outside the joint plates, as clearly shown.

Outside Elevation.

Inside Elevation.

Top View.

Section.

Price Double-Girder Joint.

It will be observed that this joint and its associates require no cutting of the ties. If, however, it be desired to use either of these joints along with tie plates upon other ties, it would be accommodated to such by making the supporting bench under the rails of the exact length of the joint and of the thickness of the tie-plates upon the adjacent ties. The vertical girder or back of these joint-plates projects so far over each tie at its ends as to insure strength at these points, besides it s use for the bolts; it also presses against the web at its inner edge.

The following test was made of the Double Girder Joint at Riehle's Testing Works, Philadelphia, June 25, 1892, with a pair of joint plates weighing, without bolts, 44 lbs. These plates were attached as a joint to two pieces of 85-lb. Pennsylvania Railroad standard rail 18 in. long and tested with the outer ends free. The supports were 15 in. apart, although the joint would permit the cross-ties to be but 12 in. from edge to edge. The load was placed upon the heads of the rails of this joint. This joint was of malleable iron. The pattern is now being redesigned to reduce weight without impairing strength, and it is believed results as satisfactory for strength and toughness can be had with a weight of 36 lbs. per pair of joint plates.

Deflection. In thousandths of an inch.	Set.	Load. Lbs.
.012	.006	5,000
.019	.000	10,000
.023	.013	15 000
.029	.005	20,000
.033	.016	25,000
.038	.008	30,000
.041	.009	35,000
.044	.009	40,000
.050	.011	45.000
.054	.013	50,000
.059	.018	55,000
.067	.020	60,000
.071	.024	65,000
.079	.029	70,000
.084	.033	75,000
.091	.040	80,000
.098	.047	85,000
.107	.051	90,000
.114	.060	95,000
.120	.065	100,000

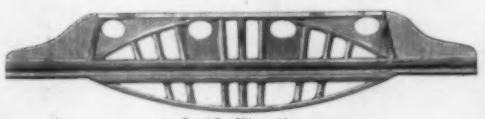
The Spoke Joint, resembling the Double Girder Joint in its use of two arches of metal, differs from it in important particulars. In this joint the top of the vertical plate outside of the curve receives the bolts, and is attached to a horizontal plate or roof, reaching the web of the rail with its inner edge, and supported at each end by a slanting foot springing from the foot of the upper arch, thus adding a second arch, nearly rectangular, of thin metal to the curve below it. Meanwhile, the vertical plate extends at each end beyond this in such shape as to give assured footing over the ties to the whole joint. The curved arches are stiffened and supported by fins and piers, as shown, securing great strength, elasticity and lightness.

It will be seen that the attachment of the lower or suspended arch comes out from the rails as far as the foot of the joint plate upon the cross ties, and that the embracing ribs contribute much to its support.

The Ribbed Truss Joint differs from its companions described in this article, especially in the position of the bolts, which bind the two plates together. These pass beneath the rails embraced by these plates, and so avoid any necessity of drilling the web. It will be noticed that the base of this joint is a horizontal plate deeply scalloped for reduction of weight and in order to permit a greater strength of the bolts and therefore a greater pressure upon the very ends of the rails as wear shall occur. From the surface of this horizontal base rise piers, which, assisted by slanting ends attached to the edge of the feet of the joint resting upon the cross-ties, give an unyielding support to the bench upon which the rails are seated. A vertical plate rises from the surface of the lip or jaw which presses, as in the other joints described, upon the rail flanges. The ends of this plate are seated upon the feet of the joint and attached to them. The upper contour of this plate is, approximately, the arc of a circle, rising gradually from above the feet of the joint. Stout ribs encircle the top and exterior, rising nearly to the upper edge of the vertical plate, and, being attached to the whole exterior, contribute great strength to the support of the joint.

The space in each section beyond the edge of the flange and within the joint plate is an allowance for "take up" or tightening as the surfaces of the rail and joint shall wear.

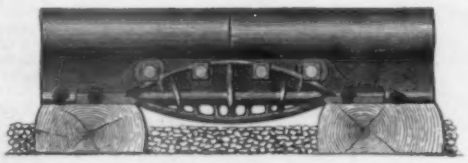
Outside Elevation.



Inside Elevation.

Top View.

Section.



Price Spoke Joint.

In these various joints, the central thought of Mr. Price has been the inquiry where to place the metal involved in his constructions to the greatest advantage to attain with a casting the maximum tensile strength for the weight and material. It has also been his purpose to discard the slanting support given by the head of a splice bar to the inclined surface of the head of a T-rail. In view of the constantly recurring fracture of splice bars, probably he is right in believing that the grasp of the flange, if made absolute and adequately "supported," is both more scientific and more promising of victory over that perennial trouble, the knocking at the joints.

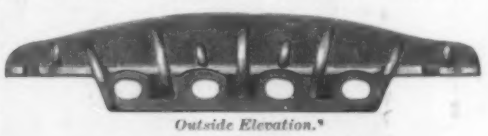
The weight of these joints per pair will, at the present interval between the cross ties, range from about 30 to 40 lbs. per pair, without bolts. By narrowing that space for those two ties upon which the rails rest, as they enter these joint plates, considerable reduction can be had in those weights, without impairment of strength.

Uniform Practice with Fixed Signals.*

It is said that during the time George Stephenson was expatiating on the great things that could and would be performed by steam when put upon wheels and driving through the country at the rate of "even twelve miles an hour," the ubiquitous bird of evil omen, in this case personified by the conservative capitalist, asked him what would happen if the locomotive should strike a cow. The answer was ready enough, "It would be bad for the coo."

Did the questioner, or the great Stephenson himself, realize the fact that this colloquy was the foreshadowing of the special committee on signaling of the American Society of Railroad Superintendents? Yet such was the case. It is just this propensity which has developed in the locomotive to hit something, everything (the wise-acre used a cow evidently merely to give definiteness to his fear), in season and out of season, which made signals necessary upon the railroads and necessitated an exposition of them and their principles before this society. It is with the greatest reverence, therefore, for the prophetic vision of the "man afraid to invest his money" that the committee approach their difficult task. Signaling of some sort must have begun with the first engine that ran, for the old methods of governing a steed were of no avail here. It were useless to cluck to an engine driver with the din of escaping steam in his ears when it should be needful for him to move on, and it were futile to shout "whoa" to him when a stop might be required. So the early railroad men must at once have dropped into the use of signs. All men are very much alike. They have the same muscles, the same five senses, and the same nerve system, so that when any unaccustomed thing is to be done quickly a majority of us will do it in the same way. Did any one ever hear of a man who would nod his head up and down to express a negative? There are, therefore, natural signs which give voice to a thought, and these will instinctively be made by most men. And there are also unnatural signs, which are those dug out of our heads by analysis and without regard to man's natural inclination.

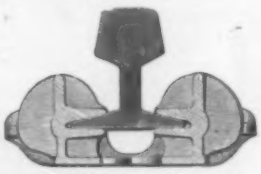
It is not too wild a flight of fancy to imagine that in the momentous work of building the first railroad, with the cars and engines to run upon it, no thought was given to the signals that were to be used, and that when the first train was made up, the nervous man in his seat (now for the first time probably really appreciating the alarming possibility of cows), and everything in readiness for a start, Mr. Stephenson, leaning out and looking back with that air of calm, better-paid-than-anybody superiority which is the heritage of all knights of the throttle, even to this time, the conductor or general manager or whosoever had to give the signal to start, found himself without copy, and had to trust to his wits to make a sign that would be understood. Is it likely that he gave much study to the situation? Hardly. He was standing behind the engine, where most men do stand who have to give the hand signal, and in an instant, without hesitation, his hand went up above his head, palm in the direction the train was to move, and it was brought down energetically just as any one of you would do to-day if you were to make a peaceable sign to anyone to get out of here. What did Mr. Stephenson see? Standing in the plane of the curve described by the arm, to his vision the hand moved up and down. He forthwith moved out, and the go-ahead signal had its birth. To-day the natural sign when standing behind an engine and asking the engineer to move back is to beckon to him in a circle, the size of the circle depending upon his distance away. And certainly the natural and instinctive method of signaling "stop" is to move one's arm or arms across the lines to be traversed by the moving object. These, then, are the natural signs, and when an investigation was made by the General Time Convention in 1883 through the chairman of its committee on signals, Mr. James McCrea, these were the signs used by a large proportion of the train mileage of the United States. These hand signals, however, together with those of train cord, torpedo and whistle, and the colors for lamps, had for some time been settled. They have been given the most careful thought by men the most competent, and are founded on solid principles. It would be unfortunate to change them now even if they were not, as they seem to be, the best that human ingenuity could devise.



Outside Elevation.

Top View.

Inside Elevation.



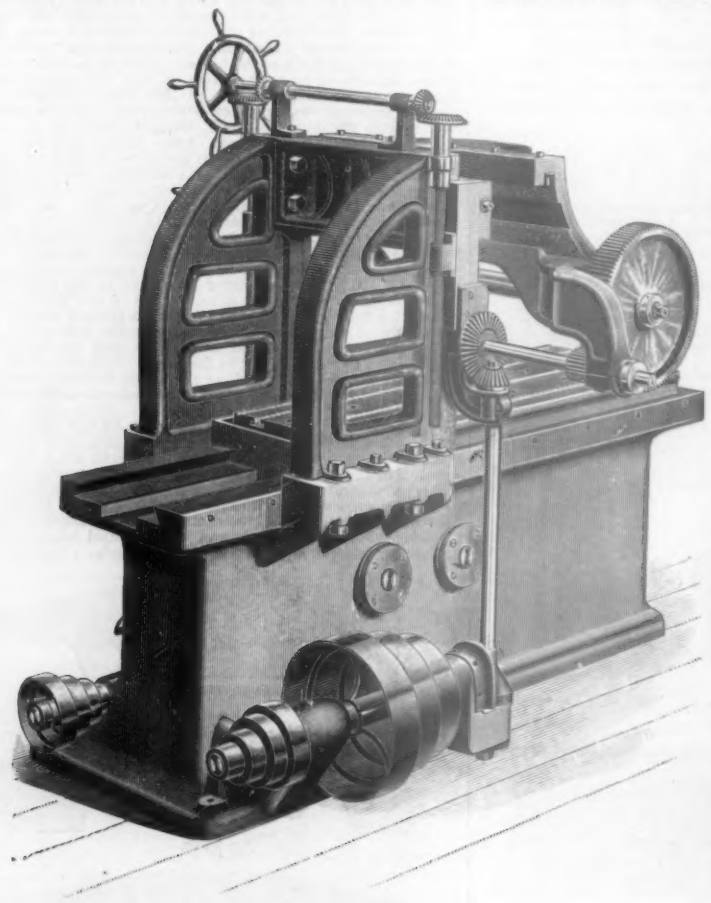
Section.

Price Ribbed-Truss Joint.

In the matter of fixed signals, so called, the standard code of the American Railway Society is, however, silent, passing them by with only the mention that such things exist. And it is in this field of the science that the most can be accomplished toward systematizing and making uniform. When railroads made their maiden bow to the public, and indeed for a long time afterward, the volume of traffic was not so great nor the demand for speed so insistant as to either crowd the roads or to make it necessary to give long notice to the engineer when stops were required. And, so, little was done toward placing signals—"fixed signals"—by the side of the road as an admonisher of an obstructed track ahead. Gradually in this country, rapidly in England, this state of affairs changed, and crowded roads with high speeds became the rule. For a long time we met the difficulty with more tracks on existing roads or with new and competing lines. In England the high price of real estate and the costly methods of construction made either of these plans undesirable, and other methods had to be devised. The plan adopted was to give greater capacity

*Report of the Superintendents' Society's Special Committee on Signaling; Mr. J. J. Turner, Chairman.

to tracks already laid and that means fixed signals. The block signal system, with distant switch signals, was followed by interlocking, and later by electric locking. Naturally the greatest amount of signaling is done upon double track roads, for it is there that crowded tracks are found, else the second track would not have been built. Such a road, furthermore, has in addition to all signaling used on single tracks, some appliances peculiar to itself, and some of the double track roads are now very completely protected. In fact, the use of the different safety appliances of this nation is increasing so rapidly that something very soon must be done toward the unification of methods and ideas, or we shall find ourselves in the condition of the Chinese civilization, crystalized to such an extent that any change will be too positive, and we shall go along in our separate ways, each entirely at variance with the other; and this broad and beautiful country of ours will be plastered with semaphores of different shapes, colors and sizes, and what will mean one thing here will mean another 200 yards away. At this day of detouring trains over the tracks of another company, and of the use of one line of rails by the crews of two or more companies, it seems essential that some uniform method of conveying the different pieces of information necessary for the passage of trains be arrived at. But we must bear in mind that while there should be no difference in the manner of signaling, there always will be differences in what we may call the degree. Some roads will always use signals to a greater extent than some others.



Ingersoll Milling Machine.

It is a popular superstition, justified, no doubt, by the facts and precedents, that when a committee is appointed it is its duty to present to the body appointing it a complete and well-digested exposition of the question at issue, together with rules for members of the parent body to follow in their application of the ideas presented. In short, a text-book is desired. In conformity with this superstition and precedents, then, there is due from this committee to day a pie into which each may introduce a thumb and pull out a plum. But where are the plums to come from? Surely the members of the committee are not the only cultivators of the fruit, and why should those of their raising be the only ones used? Notwithstanding the delight which the members would feel in being handed down to posterity as the designers, or at least the compilers, of a universal system of signaling, they are by far too modest to undertake anything of this kind. Furthermore, the subject is too young to be handled in this way. There are too many men with ideas on the subject who ought to be heard. There are many good ways to do the same thing. The main thing to be accomplished by a preliminary committee at this time is, after all, to stimulate the expression of the ideas of others rather than to advance its own. Is it not better, then, that we make a framework for a pie into which each member may cast a part or the whole of his harvest of plums? We think a pie of this kind will eventually be more palatable, although possibly not quite so soon ready for the table. Our framework, or crust, for the new signal pie we now present for your consideration. It consists of the following queries:

1. Should signals be signs of different colors or shapes, or should they change their indication by a change of position, or by color and position combined where practicable? If shape or position is to be used, how is it to be indicated at night? The practice now is to use all these methods, and sometimes all are used on the same road.

2. What instructions is it necessary to give by signals? In other words, what shall they indicate? As now used these indications are: *a*. Next switch ahead is—open or closed. *b*. Proceed under the rules. No orders. *c*. Stop for orders. *d*. Be prepared to stop at a distance of 800 to 2,000 ft. *e*. Stop and wait for clear signal. *f*. Stop for a time, then proceed carefully to the next signal. *g*. Proceed at full speed; there is no train on the block ahead; or stop and wait for the block to be cleared. *h*. Proceed at reduced speed and look out for train ahead. *i*. Proceed on a side route.*

3. How shall each of the indications be expressed? Probably the most approved methods now in use express them as follows. *a*. By a distant signal placed some length in advance of the switch target, and it is used of almost any and every size, shape and position. *b* and *c*. By a train order signal upon the telegraph office so arranged as to show safety or danger. *d*. Is used almost entirely in interlocking and is usually of the semaphore pattern with a forked blade; horizontally placed it means "The home signal is probably at danger; be prepared to stop." Placed nearly vertically, "The home signal is at safety." *e*. This is the home signal used with interlocking. It is usually a blade with a square end. Placed horizontally for stop, nearly or on some roads, quite, vertically—for proceed. *f*. This is ordinarily a home signal as in *E* and is used in automatic blocking. It cannot be distinguished from *E* excepting as its position and significance have been explained by previous instruction. *g*. This is given by the block signal which is placed vertically or nearly so for proceed and horizontally for stop. It is sometimes combined with the train order signal and must then be supplemented with a red hand signal when necessary to bring trainmen to the office. *h*. This is also given by the block system. Green is the color and with a semaphore an angle of 45 deg. to the horizontal the position. *i*. This is a signal used only in connection with interlocking and is a separate and sometimes smaller semaphore arm than the one indicating "proceed at full speed."

4. Does each of the different indications mentioned in the different divisions of the second query need a separate color, position or shape?

5. How should signals be placed and how painted to insure their being seen? Present practice varies widely.

6. In the case of the distant signal *D* should it be used to indicate safety with the main or high speed signal alone, or with the signal for side routes as well? It is now generally used with the high speed route only.

7. Given a junction with several side lines diverging from a main line, how many indications are necessary to be given? Some roads now give but two, one indicating main or high speed line open, and the other "Go carefully, you are going to be put away somewhere," while some use a signal for each track that may be taken.

8. Is it necessary to go to as great expense to make signals plain when they are used for movements from side tracks or for reverse movements on the main tracks (that is, for switching movements), as on the main line in the right direction where they will be approached at full speed? The practice now is to use a less expensive signal, though mostly conforming to the shape of the other.

9. If 8 is answered negatively, how is the saving of expense to be accomplished?

10. How far can the home signal, *E*, the train order signal, *B C*, and the block signal *G H*, be combined? As now used *B C* and *G H* are sometimes combined, and elsewhere *G H* and *E* are used in combination.

11. If no combinations are made as above, what arrangement is necessary to keep the multiciplicity of signals from being confusing?

12. If *B*, *C*, *E* and *G H* are combined how is the indication *H* to be given without confusing home and distant signal indications, and how is it to be given on the inexpensive signals referred to in the eighth query?

13. Is it safe practice to use the block signal without a distant signal. We believe block signals are now rapidly being reinforced with distant signals at all obscure places.

14. Having in mind that speeds of 100 miles an hour are discussed as probable by eminent authorities, and that high speed freight trains are upon us, how far in advance of the danger point should an engineman receive notice to stop? Present practice requires from 800 to 2,000 ft. with fixed signals.

15. How is it to be made sure that operators and levermen will uniformly give the proper signals? This is now accomplished by interlocking the levers with each other and in some instances with the towers on either side so that only the proper signal can be actuated.

16. How is it to be made certain that signals will be seen and obeyed? This is now accomplished by derailing switches.

17. Are derailing switches in the main track really of any advantage? If so, under what conditions, and can they not be advantageously substituted by some other and safer device?

18. To what extent should trains be made to lock up operators and levermen so as to prevent wrong signals being given or switches thrown in the face of approaching trains?

19. Should signals be reinforced in case of fog? If so, how? In England a man is placed under each signal during a fog, whose duty it is to keep a torpedo on the track whenever the signal is at danger.

* The English use still another called the shunting indication, which means practically proceed at a switching or backing up rate.

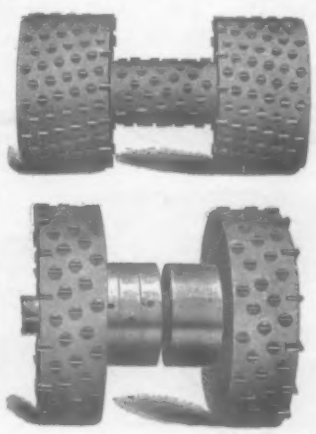
Strike at Columbus.

The switchmen of the Cleveland, Cincinnati, Chicago & St. Louis, at Columbus, O., about 90 men, struck on Tuesday last. It was reported that the company was moving a part of its freight by the aid of police protection. A few strikers were arrested for violent conduct.

The Ingersoll Milling Machine and Cutters.

The Ingersoll Milling Machine Company, of Rockford, Ill., has introduced a new milling machine which is in itself well designed and worked out, and which uses a novel system of cutters manufactured by the company.

The machine has a solid bed on which the table (20 in. wide in the one shown) rests, being gibbed to the bed and driven by a rack with a pitch of three diameters and 4-in. face, the gear being 24 in. in diameter. The traverse of the table is 5 ft. It will take work 22 × 22 in. between the standards and 18 in. high under a 4½-in. cutter.



Milling Cutters.

Two worm wheels actuate the feed and there are four changes for each speed of the cutter arbor, ranging from 3⅝ in. a minute with an arbor speed of 32 revolutions to ⅝ in. a minute, when the cutter arbor is speeded at 10 revolutions.

The cutter arbor has a lateral adjustment so that work can be put in any convenient position on the bed and the cutters afterward adjusted to it. On the elevating screw nearest to the operator is a dial which indicates the vertical movements of the arbor in thousandths of an inch.

The machine has been found to be very efficient in a variety of work, and it has a capacity for milling plain surfaces 20 in. wide at a speed of 20 in. a minute.

The cutter is made by inserting teeth, of round or rectangular steel rods, into the parts, one or more of which may be collected to make one cutter. By the arrangement of these teeth few of them are at work at precisely the same instant; yet their paths overlap, giving a smooth surface, and at the same time a very free-cutting machine. These cutters are made to mill a great variety of work and to suit any milling machine. The company makes larger machines than the one shown here.

A Method of Protecting Drawbridges.

At the Monday meeting of the Superintendents' Association Mr. C. A. Hammond, Secretary of the Association and Superintendent of the Boston, Revere Beach & Lynn read a paper on a method adopted by him for protecting a drawbridge, which we condense below:

He was recently obliged to renew a drawbridge over the Saugus. The old structure was a jack knife draw, "too wide for a single track, and not wide enough for a double track road," and from his description, apparently primitive. This was replaced by a swing draw. For the new bridge the pile bents are placed 20 ft. apart, and the use of continuous girders avoided, on account of their indeterminate strains and the upward thrust on the unloaded portions. Each stringer is 20 ft. long and abuts against its neighbor in each bay. Outside stringers were also discarded. Each track stringer consists of built-up beams, keyed with round oak keys, and bolted with screw bolts, which increase in diameter toward the ends of the stringers. The stringers rest on bolsters and the piles are driven 3 ft. centres, the stringers midway between two piles. Iron bearing plates fastened to the bolsters tie the stringers to each other. The floor is 6 in. by 10 in., ties spaced 1 ft. apart centre to centre and gained over the stringers. Outside guard timbers 8 in. by 8 in. are gained down on the ties and bolted to them. Inside guard rails are also used.

The draw rests on a central iron pivot and has two openings of 38 ft. each. This is built of through plate girders. The weight of the draw span in place is 60 tons.

According to the Massachusetts law drawbridges are protected by gates, swinging across the track, and so connected with the draw that it cannot be opened till the gates have first been closed. On the old bridge, besides these gates, a signal ball or light was suspended from the draw frame and the draw tender also displayed a flag or light. A light was carried across the bridge and right of way was given by three large target signals worked from the draw tender's house. Thus, apart from the right of way signals, trains were protected by the automatic gates, the ball signal and the flag or lantern signal. By the new arrangement the bridge is protected by the automatic gates, by semaphore signals and a safety stop device.

The details of this protection are as follows:

At each end of the two plate girders, forming the draw span, 3-in. locking bolts, resting in castings on the main bridge, and fitting the socket castings on the ends of the girders, are connected to the ends of a pair of horizontal levers, centre-pivoted to the other ends of which are fastened the pipe connections, which extend to the further end of the bridge, and are operated (through a vertical shaft and bell crank) by a stout wooden lever 10 ft. long, placed between the tracks and locked in a longitudinal position when the draw is closed. When necessary to open the draw, the horizontal lever is thrown at right angles to the main line of the bridge, thus withdrawing the two bolts from the ends of the draw girders, and by means of the pipe connections (properly compensated) actuating cross shafts and bell cranks connected with other vertical shafts at each side of the bridge, to which the gates are hung, and by which they are swung across the track. The gate shafts are located directly

PASSENGER STATION OF THE ILLINOIS CENTRAL RAILROAD, AT PARK ROW AND TWELFTH STREET, CHICAGO.

Designed by Mr. BRADFORD L. GILBERT, *Architect, New York.*

opposite to each other, but care was taken so to hang the gates that, when returning to their normal position, they shall swing *with* and not *against* the direction of approaching trains on either track.

The pipe connections from the draw-locks to the gates at each end of the bridge are continued beyond the bridge, a distance of some 500 ft., to a semaphore signal post governing the right of trains to approach the bridge. At the foot of the post, by a bell-crank, connection is made between the horizontal pipe and the vertical rod actuating the semaphore, which is thus constantly held in the inclined or safety position so long as the draw remains locked. Perhaps it is needless to say that the semaphores are of the Koyl illuminated type, requiring but one lamp, and giving a perfectly consistent signal day or night.

A still further continuation of the pipe connection was made, carrying the same 400 or 500 ft. further from the semaphore signal, to a point about 1,400 ft. from the draw itself, where, rigidly connected to the line of pipe worked by the draw-locking mechanism, was placed a novel contrivance working in connection with the signals, and designed to automatically set the brakes on any approaching train should the signals be disregarded. This apparatus is known as the Rowell-Potter safety stop, and consists essentially of a couple of jointed bars placed a foot or so outside of the rails, having a cam underneath at the centre, the same being fastened to and operated by the rod or pipe which controls the position of the semaphore in such a manner that when the semaphore is in the horizontal or danger position the jointed arms are raised to form two inclined planes; and when the semaphore is thrown to safety, the rotation of the cam allows the jointed arms to drop to a level. Upon each locomotive in the service of the road is attached, in a simple and substantial manner, a vertical lifting rod, having a friction roller at the bottom, and adjusted with reference to distance from rail, so that the friction roller must pass over the jointed bars which constitute the "ground instrument." If the latter is in a level or horizontal position, there is no movement of the lifting-rod on the engine; but if it is raised to the inclined position the friction roller and lifting shaft passing over the inclined plane are raised and held by a catch, at the same time pushing open a valve connected with the air-brake train-pipe, thus setting the brakes on the train the same as if a conductor's valve were opened. The whole apparatus is exceedingly simple, and in the opinion of the writer it possesses great merit.

It will thus be seen that when the draw-tender wishes to open the draw, the operation of unlocking it by means of the same lever and the same connecting-rod not only withdraws the bolts from the girders, but swings the gates across both tracks, returns the semaphore to its normal danger position and carries with it the setting of the safety stop ground device to an inclined position; and as these three safeguards are operated simultaneously by the movement of a single pipe connection, it is not possible even to unlock the draw without insuring that the gates, the signal and the safety stop shall all be against the approaching train.

It may here be remarked that, should the bell crank connecting the operating lever to the line of pipe break, the locking bolts could not be withdrawn from the draw girders, while should the connections at the semaphore post and at the safety stop instrument break, counterweights would carry both signal and ground instrument to the danger position; and by locating the compensator in the line of pipe at or near the signal post, any breakage in the same would also set the signal and safety stop at the danger position by the counterweights.

Each end of the drawbridge is protected by its own set of signals and connections, operated by the locking mechanism at each end of the draw proper.

Mention may here be made of the means used to bridge over the gap between the rails on the draw and those on the main part of the bridge. This has been accomplished by bolting steel angle blocks to the outside of the rails at the joint, so that the blocks lap by the ends of the rails, and being of the same height as the rails at the joint and the top surface of the block slightly beveled off either way from the same, the outside of the wheel tread is carried over the joint opening without battering the ends of the rails or causing a disagreeable shock. The blocks are, of course, bolted alternately to the fixed rail on the main bridge, and to the moving rails on the draw, the portions of the blocks which lap by the joint being unfastened.

Before concluding, a few words further concerning the Rowell-Potter Safety Stop may be of interest. The apparatus has been applied on the Boston, Revere Beach & Lynn Railroad, not only to the drawbridge signals, as above described, but also to those governing tunnel approaches and to facing point switches: and it is in contemplation to extend the same to other points needing protection. The system consists essentially of two parts—the locomotive attachments and the ground attachments—as previously described. In order to make its operation absolutely certain, it was thought best to provide rigid pipe connections between the signal or switch and the safety stop, although it is probable that satisfactory results can be obtained by the use of wire connections. No difficulty has been found in running a length of pipe from the tower situated on one side of a tunnel of some 500 feet in length, through the same and round two curves of rather short radius, a distance of 1,500 ft. to the signal, and a further distance of 700 or 800 ft. to the ground instrument. An additional feature has been added to the latter device, by which every train that finds the jointed levers down in the safety position, automatically in passing the same trips them to the inclined or danger position, each train thus protecting its rear against a following train; and this motion of the safety stop device is made to correspond to the movement of the semaphore arm of the signal governing the right-of-way through the tunnel, to which signal a similar tripping device was applied, in order to prevent the possibility of two trains, the second closely following the first, getting a right to enter the tunnel under the same signal, should the towerman fail to replace the signal after the first train has passed it.

Another advantage is offered by this system of train protection by the use of a portable inclined plane, which can be made of wood and arranged to be quickly set in proper position alongside the track, so that when so placed it will far more effectually protect a train than the rear flagman is likely to do with the present means at his disposal.

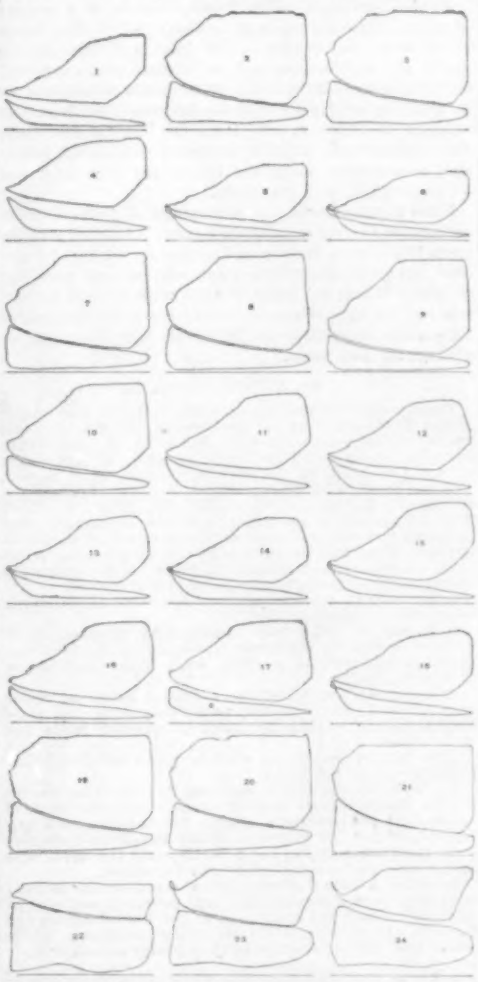
Improvements at the Marquette Harbor.

The bids for the improvement of the harbor at Marquette, Mich., were as follows: Wisconsin Dredge & Dock Co., $81,910; Berner & Lantz, $69,800; Campbell & McDonald, $80,760; Hugh Steele, $80,830; Powell & Clayton, $65,351, and Moore, Sang & Nicholson, $76, 070.

Indicator Cards From the Johnstone Compound Locomotive.

In the *Railroad Gazette* of Aug. 26, 1892, was given an account of the Johnstone compound locomotive tests on the Mexican Central Railway, made for Mr. D. L. Barnes by Mr. F. M. Whyte, formerly of the testing department of the Baltimore & Ohio road. A full report of these tests has been issued by the Mexican Central in pamphlet form. It contains the data, in detail, of the action of the engines on the grades of the First Division of the road. In addition to what has been given in these columns before, cuts of 24 indicator cards accompany this.

These cards show the action of steam in the Johnstone compound cylinders, and are necessary to explain some of the tables given in our former account. Cards Nos. 1, 5 and 6 show the action of the steam in the cylinders when the engine is working with the highest speed obtained in freight service. Cards Nos. 2, 3, 7 and 8 show the distribution of steam when the engine is working at slower speeds averaging about 12



Indicator Diagrams from Johnstone Compound Locomotive —Mexican Central Test.

miles per hour. Cards Nos. 22, 23 and 24 are particularly instructive, as they show the effect of the working of the engine in what is called "high pressure," but what is, in fact (and this is true for all compound engines) simply working with the admission of a small amount of steam direct from the boiler into the low pressure cylinder. The opening between the boiler and low pressure cylinder is not sufficient to enable the engine to use high pressure in both cylinders unless the speed is extremely slow.

Take the case of the cards 22, 23 and 24, just mentioned; the speeds are 5½, 8¾ and 10 miles an hour respectively. At these low speeds the opening that is provided for the admission of steam from the boiler to the low pressure cylinder is not sufficient to admit anything like full boiler pressure. This is true of all compounds used in this country, except those built by the Rhode Island Locomotive Works, which have a special provision for working the engine precisely like a simple engine as long as desired. Taken altogether, these cards show an admirable adjustment of the valve gear and a good steam distribution, and they compare very favorably with the indicator cards from other compounds.

The Wheel Record.

In the *Journal of the Association of Engineering Societies* for August is a paper by Mr. J. N. Barr under the above title. We select certain extracts from it, enough to show his theories of the record and something of its history on the Chicago, Milwaukee & St. Paul, of which Mr. Barr is Superintendent of Motive Power.

It is found that wheels fail or are condemned principally from four causes:

1st. Failure of the shell of chilled iron. 2d. Abrasion. 3d. Breaking or fracture. 4th. Application of brakes.

Under the head of "Failure of Chill" there are four distinct forms which manifest themselves; three of these are due to disintegration of the white iron and are termed "Shelled out," "Comby" and "Seams." The fourth form is caused by wearing through the shell of white iron where it is thinnest, and is distinguished by the term "worn flat."

The failures due to "Abrasion" may be classed under two heads: "worn flange" and "Tread worn Hollow," but in nearly every case in which a wheel is condemned on account of tread being worn hollow, the wear is not evenly distributed over the tread, but occurs either close to the flange or out on the tread entirely removed from the flange. It has, therefore, been found convenient and useful to distinguish between these and use two terms: "Tread worn hollow at Flange" and "Tread worn hollow from Flange."

An inspection of a number of broken wheels reveals the fact that each particular form of pattern has to a great extent its own peculiarities as to manner of breaking, but the wheels under this head may be classified as follows: "Broken Flange," "Broken Rim," "Cracked Plate," "Cracked Between Plates," "Burst" and "Broken in Pieces."

Under the head of wheels condemned on account of application of brakes, the one term "Flat from Sliding" is used.

The above mentioned small list of defects really covers the whole subject, and when carefully applied in a record will give definite information as to the condition of condemned wheels.

With regard to influence of service, it can only be said at this point that no definite results can be obtained as long as it is attempted to consolidate the returns from wheels of different sizes, or from wheels of the same size, under cars or engines varying much in weight or speed.

STATEMENT SHOWING DEFECTS OF CAST IRON WHEELS AS INFLUENCED BY KIND OF SERVICE DURING 1892.

Class I. (Chill failing.)

Kind of service.	Diam. of wheel.	Shelled out. No.	Shelled out. Average mileage.	Shelled out. %	Comby. No.	Comby. Average mileage.	Comby. %	Seams. No.	Seams. Average mileage.	Seams. %
Passenger	33	148	94,067	16 8	1	92,307	0.1	12	99 868	1.4
B. M. & Ex	33	178	98,891	27.7	...	...	...	11	113,850	1.3
Parlor and sleeper	33	7	91,517	36.8	...	...	...	...	...	...
Engine tender	34	1,277	60 724	53.	6	87,100	2.	18	97,498	7.
" "	30	38	65,472	41.9	...	...	...	1	35,762	1 1
Engine truck	34	390	48,691	49.2	2	31,580	0.3	15	83,860	1.9
" "	28	313	40,771	53.2	7	40,771	1.2	4	60 161	0.7
" "	26	13	31,001	27 7	6	31,001	12.8	...	...	...

Class II. (Wear on Rail.)

Kind of service.	Diam. of wheel.	Worn flange. No.	Worn flange. Average mileage.	Worn flange. %	Worn thread. No.	Worn thread. Average mileage.	Worn thread. %	Worn flat. No.	Worn flat. Average mileage.	Worn flat. %
Passenger	33	67	97,413	7.6	61	119,263	6.9	4	105,547	0.5
B. M. & Ex	33	65	110,426	8.3	39	125,168	7.5	7	115,025	0.9
Parlor & Sleeper	33	2	77,030	15.8	1	153,145	5.3	...	...	...
Engine Tender	34	318	80,332	13.2	86	107,167	2 3	49	121,768	2.
" "	30	3	99,579	3.3	5	109,562	5 5	24	69 610	25.3
Engine Truck	30	240	55,504	26 5	46	86,136	2.0	10	63,020	1.3
" "	28	110	75,918	16.8	17	89,966	2.9	9	51 075	1.5
" "	26	2	52,201	4.3	...	.....	....	19	41,701	40.1

Class III. (Broken.)

Kind of service.	Diam. of wheel.	Cracked plate or brackets. No	Cracked plate or brackets. Average mileage.	Cracked plate or brackets. %	Other defects. No.	Other defects. Average mileage.	Other defects. %	Total. No.	Total. Average mileage.
Passenger	33	1	104,091	0.1	854	46,994	40.1	863	77,437
B. M. & Ex	33	..	...	.	250	45,650	31 8	785	88,629
Parlor and sleeper	33	..	...	...	2	5,940	10.5	19	86,780
Engine tender	34	1	33,288	...	247	44,928	10 2	2,411	69,4 2
" "	30	..	...	...	7	46,560	7.7	91	69 206
Engine truck	30	..	.....	...	80	58,664	10.1	735	53,679
" "	28	1	9,279	0.2	91	58,552	15.8	504	47,523
" "	26	..	...	.	5	52,344	10.6	47	39 604

Class II. and III. (Wear on Rail and Broken.)

Kind of service.	Diam. of wheel.	Worn hollow at flange. No.	Worn hollow at flange. Average mileage.	Worn hollow at flange. %	Worn hollow from flange. No.	Worn hollow from flange. Average mileage.	Worn hollow from flange. %	Broken rim or flange. No.	Broken rim or flange. Average mileage.	Broken rim or flange. %
Passenger	33	6174	91,511	19.7	49	106,020	5 5	12	115,583	1.4
B. M. & X.	33	146	93,594	18 6	55	113,717	7.	14	118,868	1.8
Parlor and sleeper	33	6	102,016	31.6	...	...	...	...	...	...
Eng. tender	33	259	82,936	10.7	112	103,569	4.7	67	89,532	2.8
" "	34	1	39,527	4.6	2	39,957	2.2	8	99,7	8.8
Eng. truck	30	57	62,197	4.7	16	61,671	2.	17	76,272	2.1
" "	28	26	45,897	4.4	14	49,202	2.4	6	49,60	1.
" "	26	...	.....	...	.....	.....	...	2	35,881	1.3

We have now taken, as it were, a flying observation of the qualities of car wheels in general, of the manner in which they fail in service, and have the fact that the character of service exerts an important influence on the mileage of wheels. An adequate wheel record will give accurate information on all these points, and from this information a correct idea of the merits of the wheels should be obtainable. If a railroad company does not make its own wheels the question is much simplified. But when wheels are also made, the question is much complicated by records of material used and foundry manipulation, but this part of the record will not be considered.

It will possibly be interesting to give a short sketch of the origin and development of the wheel record, so far as my experience goes, and this will no doubt give additional point to some of the preceding remarks. When the wheel record was first established, reports were made weekly from each shop of all wheels used under and drawn from passenger equipment cars and from engines. These reports gave the wheel number, the date cast, the car number and the condition of the wheels drawn. The mileage of the wheels drawn was ascertained from the record of car mileage. At the end of the year a statement was made of the mileage of wheels drawn. The statement showed the average mileage of wheels of the same size drawn from passenger and freight engines collectively, giving each make of wheels separately. Each man reporting wheels used his own discretion as to the best manner of describing the condition of the wheels drawn.

You will notice here that a distinction was made between the service of wheels under cars and under engines. This was a step in the right direction, but as you will see further on it did not go far enough, and the maker who was fortunate enough to have his wheels placed under freight engines had about 2,000 miles in his favor, as compared with the same quality of wheel placed under passenger engines. The record was continued in this form for several years, but in a short time there was a distinction made between wheels under passenger engines and freight engines. Soon a separate statement was made for wheels drawn from Pullman cars. Many of the wheels reported found their way to the wheel foundry and an endeavor was made to compare the condition of the wheel with the reports from the road, but met with a repulse at once from the formidable array of terms used in describing the condition. For example, the condition of the wheel designated by the term "shell out" was described in the weekly reports by the following terms: Rough, Worn out, Bad manufacture of chill, Flaw on tread in casting sandholes, Bad chill, Worn in holes and Flaws. Each shop had its own pet term, and in that case the same term did service for almost any condition of wheel. In view of these discrepancies a circular was issued by our company which required inspectors to use the terms before mentioned and none other. This certainly resulted in a great reduction of the number of terms used on the weekly reports, but the men were not inclined to use this term with sufficient discrimination to guarantee strict accuracy and the old tendency to a fondness for the use of some particular term began to manifest itself.

After the wheel record had been in operation about five years, one of the most important steps in the history of the record was taken. It was required that all condemned wheels drawn during any month should be shipped to the foundry before the tenth of the succeeding month. These wheels were all inspected on unloading them from the car, and the report of the condition of the wheels from this inspection placed on the record beside the report from the road. All discrepancies were promptly reported to the inspector responsible for the same, and in a short time such discrepancies were few and far between.

In addition to securing more accurate records, another and extremely important result was accomplished; the proportion of wheels found to be good for further service increased enormously.

A distinction was made between the mileage of wheels drawn from baggage, express and postal cars, and the ordinary passenger cars, including combination and emigrant cars. This was the last important change made in the record.

In addition to the regular weekly reports on which the record is based, a special report is made of each wheel found cracked or broken. These reports give a full description of the nature of the fracture and the direction of train, as well as the nearest station to the point the fracture was discovered.

In order to illustrate the above remarks a copy of the annual report of wheels removed and scraped on the Chicago, Milwaukee & St. Paul Railway for the year ending Dec. 31, 1890, is attached. This statement shows the number of wheels removed from each class of service and the average mileage of the same; also the number removed for each defect and the average mileage, also the percentage of wheels removed for each defect. In comparing wheels of different make or wheels of the same make for different periods of time, a decrease in the percentage of shelled out, Comby, Seamy and worn flat wheels, or an increase in the mileage of wheels condemned for these defects, indicate the better wheel. A perfect wheel should only wear out by wearing the flange thin, or wearing the tread hollow, therefore an increase in the percentage of wheels condemned on account of worn, flange or tread worn hollow, or an increase in the milege of the same, indicate improvement.

We have had the curiosity to apply to the wheels drawn on Mr. Barr's road for a number of years the test that he prescribes in the paragraph above. To that end the percentages and mileages of wheels drawn for various defects are grouped in the table below. It was only in 1887 that the use of wheels made in the Barr chill had got into such large use on that road as to affect the record; and the comparison of 1890 with the three years 1886, 1887 and 1888 ought to give fair conclusions. We have taken wheels drawn from passenger cars only.

		1886.	1887.	1888.	1890.
Shelled out	Per cent..	16.2	25.3	24.8	16.8
	Mileage..	56,166	69,007	82,662	92,007
Comby	Per cent..	1.2	0.5	3.4	0.1
	Mileage..	70,790	69,647	46,691	92,307
Seams	Per cent..	10.4	9.5	3.4	1.4
	Mileage..	46,235	59,467	79,048	99,888
Worn flat	Per cent..	9.2	11.8	1.6	0.5
	Mileage ..	71,514	86,111	65,588	105,547
Worn flange	Per cent..	9.2	3.0	1.6	7.6
	Mileage..	68,184	89,309	80,581	97,413
Worn tread	Per cent..	14.8	13.0	17.0	6.9
	Mileage..	73,099	97,892	101,111	119,263

It will be seen that the records show a very substantial improvement.

Rail Joints.

The rail joint question suddenly comes up as if from the grave. Seven years ago the Engineers' Society of Western Pennsylvania appointed a committee to investigate and report upon this matter, and the history and results of the work of that committee are now first made known to the world. At a meeting of the Society held last June, Mr. W. L. Scaife read the paper which we print below, telling the fate of this investigation. It will be noticed that the answers to the circulars sent out by the committee are referred to by Mr. Scaife in his paper as having been tabulated. The tables, however, we do not print, as they cover a great deal of space, and although somewhat curious, are practically worthless.

We have not taken the trouble to dig out from them the mileage of railroads reporting as using supported or suspended joints, for the history is too old, but on very much the greatest mileage the joints were suspended.

The inquiry as to whether or not joints break more frequently on curves than on tangents is answered in the negative a good deal oftener than in the affirmative, although seven replies are that they do break more frequently on curves, and of these, four say that they break more frequently on the inside rail. One says that they break twice as often on curves, and another one says that they break oftenest on tangents. As to the relative breakage on bridges also, the great preponderance of evidence is that there is no difference, although three of the companies report that they break oftener on bridges than on the ground.

As to where angle splices break, there is, as a matter of course, little difference of opinion; that is, they break at or near the middle of the joint, and from the top down, although one company which used both supported and suspended joints, and a 13 lb. plain splice, and 30 lb. angle splice, reports that the breakages are generally through the first bolt hole from the middle, and from the bottom up. Another company reports the breakages as occurring along the line of the horisontal and vertical members of the angle.

From the reports of the percentage of joints broken, nothing of any value is to be gleaned. One company reports 10 per cent. broken in four years, another 2½ per cent. in two years, another 6 per cent. in one year, but generally where any effort at all is made to give the percentage, the time is not specified. One company reports a breakage of one in every 2,870 every year, this being an average for five years.

MR. SCAIFE'S PAPER.

During the year 1885 considerable interest was manifested in rail-joints by the members of this Society, and the following committee was appointed to investigate the question of rail joints, and to make all necessary tests of the merits of different splice-bars then in use: Thomas Rodd, Chairman; Max J. Becker, H. W. Borntræger, W. R. Jones, C. L. Strobel, W. L. Scaife, Wm. Scherzer, James G. Dagron and Frans Engström. Mr. Scherzer was the first Secretary, and on being called to another city, was succeeded by Mr. Engström. After some discussion, and in order to make the investigation as thorough as possible, the Committee proposed:

1. To test, in tension and by bending, samples cut from each lot of splice bars.

2. To test the splice bars, attached to short pieces of rails; in a testing machine, by applying loads corresponding as nearly as possible with those encountered in actual practice.

3. To place a number of the different kinds of splice bars on track, where all will be subjected to the same conditions and to note the effect of passing loads and wear of bar.

4. To test, in connection with the splice bars the different varieties of nut locks.

As the society provided no funds for carrying on the works, circulars were sent to various manufacturers of splice-bars and nut-locks, asking for samples and subscriptions for the purpose. Many generous responses were received in reply, but unfortunately the work was never advanced far enough to call for either.

In order to have the benefit of the experience of railroad engineers, Circular No. 2 was prepared and sent to most of the railroad companies in the United States and Canada. It contained the following questions, which were believed to cover the subject pretty thoroughly:

1. What is the length of lines on which splice bars are used? 2. What per cent. of line is on a grade, approximately? 3. Are the grades generally over or under 1 ft. to 100 ft.? 4. What per cent. of curves, approximately? 5. Are the curves generally more or less than 5 degrees? 6. What kind of ballast is used? 7. What is the greatest weight on drivers and per driver? 8. What is the distance apart of driving wheels, axles? 9. Length of standard rail? Material? 10. Cross section and weight per yard? (Refer to book). 11. Sizes and distances of holes from end? 12. Cross-section, and length of ties and kind of timber? 13. Distance apart centres, at joint elsewhere? 14. Of what material are your splice-bars? 15. Weight, cross-section and length? 16. Is joint over tie or suspended? 17. What per cent. of bars break? 18. Do they break on straight lines or curves, or both? 19. Do they break more frequently on curves? 20. Do they break frequently on bridges and trestles? 21. Where does the fracture take place, and how? 22. For how many years has the section been used? 23. Is it satisfactory? If not, what changes would you suggest? 24. Have you made tests of bars or material? If so, please give results. 25. At what points, preferably convenient to large cities, can the Committee personally examine good examples of track put up with the joint used that has been in service for some time?

In response to these and other circulars, as well as special letters, answers were received from engineers, general managers and superintendents of about 61,000 miles of railroad. Many of them were accompanied with drawings of rails, splice-bars, roadbeds, nut locks, etc., and furnish much valuable information outside of the questions contained in the circulars. All of these original documents will be found in the library of the Society.

It was found impracticable to carry out the tests, as originally intended; and meetings were discontinued after May, 1888, no report being made to the Society owing to the absence of any actual tests. It occurred, however, to the writer, that a brief summary of the answers received would have a historical value, if nothing more; and might be of service to similar committees of our own and other societies. Moreover, some explanation, though tardy, is due to those gentlemen who so courteously complied with the request of the committee in hope of increasing the knowledge of this important subject. If we cannot give them a report as promised, we can at least offer them a summary of the replies sent out.

These were carefully tabulated by Mr. Engström at the time they were received, and are hereto annexed: Table I. covers 35,600 miles of railroad, and includes replies of those in charge, who were satisfied with the splice-bars then in use. Table II. refers to those who were in doubt or dissatisfied with the then existing joints, and represents about 25,500 miles of road. Table III. has been calculated by Mr. Engström, and shows for the various railroads approximate values of the area, radius of gyration, moment of inertia, and centre load at elastic limit, of the rails and splice-bars, together with their relative values. The accompanying diagram shows the same values graphically.

An examination of these data cannot fail to show wide differences of opinion where they should not exist, and which it was the object of our Committee on Tests to settle. Considerable progress has been made since these communications were received, and the writer hopes that some of our railroad engineers will add to this imperfect historical fragment the results of their more recent experience in rail joints.

DISCUSSION.

MR. MAX J. BECKER: As one of the members of the Committee on Rail-Joints, I wish to say that I quite agree with Mr. Scaife that some apology is due to the Society who appointed the committee fully six years ago, and also that some explanation should be made to the different parties, who, at the solicitation of this committee, contributed information and tendered their services and assistance in connection with the investigations, which were commenced diligently enough, but not prosecuted with the zeal and energy with which they were begun.

Of the nine members who constituted the committee, the most active one, who was best qualified for its work, on account of his connection with the establishment upon which we principally depended for making the tests, died; four other members removed from the city and severed their connections with the Society. The remaining four, myself among the number, have found it impossible to devote the necessary time to the subject in their charge, which its extent and importance seemed to demand.

Moreover, the causes, which created the interest in the subject, and led to the appointment of this committee, have, in a great measure, disappeared, so that at this time even the information collected and tabulated in the statements referred to by Mr. Scaife will be found of little practical value, and of no particular use for actual application.

What gave the subject its importance six years ago was the alarming destruction of the rail-joints under the traffic, and the consequent danger to which life and property was exposed. When attention was directed to this state of affairs by the discussions which the subject brought forth, pains were taken at once to strengthen the joints by increasing the sizes and improving the shapes of the splice bars, which very soon resulted in a general and well-marked improvement in the rail joints on nearly all the better roads in the country. Many new devices were introduced and placed upon trial, but the angle bar type which largely prevailed six years ago is still continued by preference in its improved form, and now gives such general satisfaction that very few other devices have survived a temporary trial.

Not only have the angle bars themselves been increased in size for the sake of strength, but the constantly increasing rail-sections have naturally compelled larger dimensions in the angle bars, and since this increase is mostly in direction of the height, the strength and stiffness of the bars have consequently gained in double proportion. It is also conceded that by the gradual use of steel in the manufacture of angle bars, their wearing quality as well as strength has been considerably improved over the old iron bars, which, it is likewise conceded, were not always composed of the choicest metal which the market afforded.

By the lengthening of the angle bars, and the introduction of additional splice-bolts, it is generally believed that the joints are made smoother and stronger.

Furthermore, by the introduction of heavier rails, the perfecting ends of the rails themselves are strengthened and the depressions at the joints, which have been the principal causes of the breaking of the splice-bars heretofore, have been reduced to a very great extent.

The questions, with the solution of which this committee was charged, have thus practically solved themselves in actual practice and in a manner far more conclusive and satisfactory than could possibly be done by either theoretical investigations or experimental tests or both combined.

The committee finds itself, therefore, impressed with a feeling that its "occupation is gone," and with regrets for its shortcomings and apologies for the disappointments which it may have caused you, I, for one, would respectfully request that it be relieved from further duty.

MR. FRANK ENGSTROM: A glance at the tables shows that the angle bars most generally break at the centre from top downward. I fail to see how this could cause any surprise. The top fibres already exposed to the severest punishment by being at the greatest distance from the neutral axis, are still more handicapped by the narrowing up of the section at this point; whereas, the bottom fibres, in addition to the advantage of a wider section, also are given more play-room for their elasticity in the lower flange before they could begin to break. This is independent of whether you prefer to consider the bar broken by the two rail ends acting as cantilevers or by the upward bending moment which, if the joint ties should happen to be tamped a trifle more solid or higher than other ties, may be more dangerous.

One answer (from N. P. R. R.) ascribes the failure of the bars to an entirely different cause—the thermometrical range; and no doubt this has a great deal to do with it in a location where the thermometer without the least hesitation jumps from 115° above zero, in the shade, to 46° below zero; sometimes as much as 60° within six hours. Others lay the whole blame on the condition of road-bed, ballast, etc.

As we learn most from the mistakes of ourselves and others that come under our observation, I was under the impression that we were going to reap the richest harvest of information from those who were not satisfied. It will be seen, however, that table No. 1 gives pretty nearly as many suggestions as the other one, and it is amusing to note how several answers strained the meaning of "satisfied" by telling how they were going to change the bars. And, as far as my knowledge goes, the by far greatest improvements are made on roads which at the time were perfectly satisfied with the joint as it then existed.

President HUNT: I might add here in line with the question of quality already referred to by the committee, that in the manufacture of these fish or angle bar joints since the failure of natural gas in the Pittsburgh district, there is an increase in the number of steel bars over iron. In my own experience I find that at least 75 to 80 per cent. of all the orders we inspect are of steel. There are still some 20 to 25 per cent. of the angle bars

being made of iron. Two years ago the proportion was not over 50 per cent. and two years before that I think the proportion was five per cent. of steel. I would like to ask Mr. Becker what his experience has been in the rapidity of the change in the use of steel joints over the iron joint?

Mr. BECKER: The information that one gets by making inquiries is very varied. I am a member of an official committee, which, among other things, is charged with an investigation of this very subject; and we have been trying to find out what proportion of steel angle bars is now being used. We have addressed the manufacturers of angle bars and they have sent us lists of the parties who have ordered steel angle bars, and then we have addressed the parties who were named in the circulars, and we got responses which I will mildly call "contradictory." The two do not "gee" very well. The fact of the matter is, even at the present time, although most everybody will say that at equal prices steel bars will be better and more economical in the long run, yet but a very small proportion of the whole are being used. The Pennsylvania Railroad is not using any except perhaps for experiments. Our lines have not used any yet. A number of the officers of the lines referred to by the manufacturers stated they had simply ordered some as samples for the purpose of making experiments; and others who had ordered them were not prepared to say they had any great superiority over iron, although they thought they had some. I am quite willing to express my own belief in that direction. But there is one thing quite certain, that the whole excitement regarding the dangerous condition of the trac with regard to angle bars has practically died out There is no longer any danger from that source. It was in this Society reported some seven years ago that on one five mile division of our road there were some 1,600 broken angle bars; to-day we have no reports of broken angle bars from any part of the road. There is no longer any necessity for discussing the subject.

of a thickness to do any good you have then to resort to a longer spike in order to get the same adhesion of the rail on the cross-tie, for you lose the effective length of the spike to the extent of the thickness of your plate. That is about my idea of a tie plate.

MR. EDWARD B. TAYLOR (communicated): While the committee has furnished us some very interesting statistical information, yet the attention which the subject received some six years ago, when the Committee was appointed, has resulted in a material improvement of the splice bars as well as the rails themselves, so that there is not the trouble at this time that there was in 1885. Personally I believe that the perfect joint will be not only a splice, but a bridge, and I think that the new Fisher joint approaches more nearly the perfect mechanical joint than the angle splice, although there is a prejudice against this joint on the part of many of the engineers and road masters, because it is not well adapted for switch connections, and requires the adzing of the joint ties, or, if this is not done, the sinking of the joint ties below the general level of the other ties, causing the water to collect in and about the joint ties and theoretically making it a little more difficult to maintain the track in good surface; although, I believe, the experience has been that even with the old Fisher joint, which was simply a bridge, the surface of the track was kept in better condition than where angle bars were used.

THE SCRAP HEAP.

Notes.

The Southern Pacific has dismissed 150 men from the shops at Houston, Tex., and, it is reported, is curtailing expenses in other departments.

At Indianapolis last week Wednesday, the tax collector for all highway crossings within the limits of Bridgeport by all eastbound engines after crossing Fairfield avenue, and by all westbound engines, except at the crossing of Pembroke Pond. It is required that the engine bell be rung instead.

The Southern Pacific (Railroad) Company and the Wells-Fargo Express Company have sent $6,000 to Coffeyville, Kan., to be paid to the citizens who shot the members of the Dalton gang of robbers in the affray there last week. These companies had offered the reward on account of train robberies committed by these desperados. Chicago bankers intend to raise a purse for the families of the men killed by the gang in Coffeyville, and will present a gold medal to James Spear, who shot three of the robbers.

The High Nile.

The high Nile is taxing to the utmost the energies of the irrigation officers and governors of districts of lower Egypt. Several breaches in the dikes have already occurred, and have interrupted, more or less seriously, railroad and telegraphic communications south of Cairo. So far they have been quickly repaired, or the the mischief has been confined to narrow districts. It is still hoped that the cotton crop will not be seriously damaged.

Railroad Improvements.

The intelligent Chicago correspondent of the New York *Evening Post* writes: "The complaint of scarcity of motive power and freight cars continues among all leading railroad lines connecting Chicago with the interior, and in addition to the liberal orders for these equipments recently placed with engine and car builders, the shops of the roads are busy on such work, their

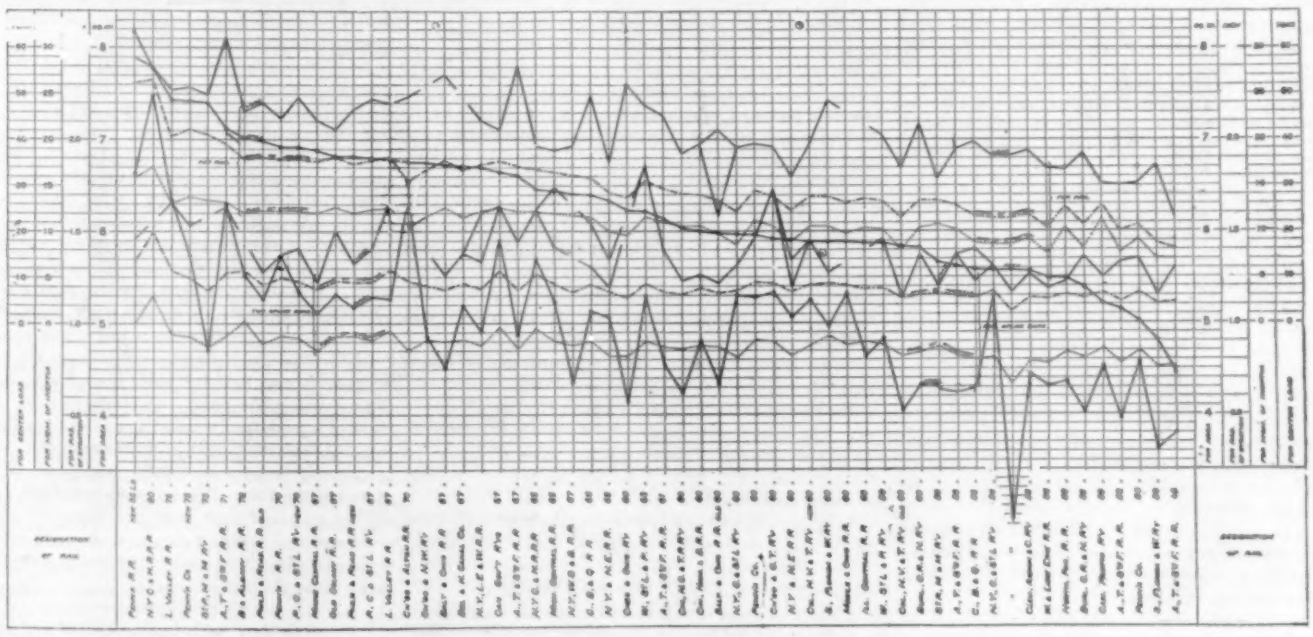


Diagram with Mr. Scaife's Paper on Rail Joints.

President HUNT: I am at present inspecting rail joints for five different railroads. The steel is soft Bessemer steel, .10 to .15 carbon. It is steel of from 50,000 to 65,000 lbs. tensile strength per square inch, an elastic limit of one-half the ultimate, an elongation of 20 per cent. minimum in eight inches and a reduction of area of at least 35 per cent. It is a lower requirement than for bridge materials. Some of the roads require 40 per cent. reduction of area.

Mr. VICTOR WIERMAN: Our experience has been similar to Mr. Becker's. As to breakage, we have experienced but little trouble from that source since the rail section has been increased and the angle bar proportionately made heavier.

We have tried a great many different styles of splices on the Pennsylvania Railroad during the past few years; some have had merit, more had not. But we always come back to the old pattern, angle-splice bar. It is a good joint, the best I have yet seen. It is not perfect by any means; I would like to have a better one; most railroad men would, but for all around work it stands the service better than any yet produced as far as I have seen.

Mr. S. L. TONE: I would like to hear the opinion of the Committee on the difference between a supported and a suspended joint; whether it is advisable to put a plate under the supported joint.

Mr. BECKER: I will refer the gentleman to a paper which I read here some six years ago. If everything is in print here, as has been stated by the Secretary, that paper is accessible. I think I dwelt on the difference between suspended and supported joints, and also upon the so-called three-tie support as against the two-tie support. As to the plates on the tie I will say I do not believe much in tie plates. I know that is a very popular subject just now, and there are some very pretty pictures sent around by the parties engaged in the manufacture of these plates, but I have about made up my mind that I would not use a tie plate on the ordinary good size hard wood cross-tie. I believe that the tie plate might be of some service in cases where the tie is liable to wear out by the friction of the rail earlier than it would by internal decay. Where, for instance, the tie is wholly removed from the cause of decay, as on a bridge, and is liable to be scarfed by the action of the rail, a plate may possibly induce a little longer life in a tie, but when the tie dies from rottenness I do not think any tie plate will save it. On the contrary, I am not sure but that the plate will hasten it along.

There are other objections to tie plates. One is they are not made of sufficient thickness, and I notice that they buckle and twist, But even when you make them

or seized locomotives and electric lighting machinery of nearly or quite all the railroad companies entering the city.

The shops and the round house of the Pensacola & Perdido, at Pensacola, Fla., were destroyed by fire last week. Three locomotives were in the round house. The loss is about $20,000 and insurance $5,000.

The Illinois State Board of Equalization has just completed its task of assessing the 99 railroad corporations of the state, with 9,435 miles of main track, an aggregate of $77,108,390, which is about $2,500,000 in excess of the assessment of last year.

The annual meeting of the Traveling Passenger Agents' Association was held at Washington last week, and elected these officers: President, Joseph W. White, of the Georgia Railroad; Secretary and Treasurer, H. C. Holabird, of the Erie.

It is reported that railroad employés in Kansas are organizing clubs for the purpose of defeating at the polls every political candidate who is pledged to the reduction of railroad rates by statute, the employés believing that every reduction so effected would cause a corresponding reduction in their wages.

The Massachusetts law prohibiting the use of fire in passenger cars goes into effect on Nov. 1. Most of the roads have prepared to obey it. The Railroad Commissioners have exempted the Webster branch of the Boston & Albany, the Housatonic, mixed trains on the Old Colony, the Hoosac Tunnel & Wilmington, and the Grafton & Upton.

The old suit of the Wiggins Ferry Company, of St. Louis against the Chicago & Alton, involving some three or four hundred thousand dollars for a breach of contract in carrying freight several years ago, has again been the subject of a decision, the United States Circuit Court overruling the Alton's exceptions to the verdict given several months ago.

The Railroad Commissioners of Connecticut, upon petition of the Mayor and Common Council of Bridgeport, have issued an order directing the New York, New Haven & Hartford to omit the sounding of the whistles

output being placed in active service as quickly as finished. Track materials are likewise in brisk demand from all directions. Referring to increasing outlays for rolling stock and track betterments, the manager of one of the largest lines centering in Chicago said: 'It is our aim to place our line in a physical condition that will enable us to handle a greatly enlarged business without entailing a corresponding increase in operating expenses. Hence we are making substantial improvements wherever it can be advantageously done.' In this connection it is proper to say that there is a growing tendency to the use of heavier rails. . . . It is said that the main line of the Chicago, Burlington & Quincy has now only two wooden bridges on it, and they will be replaced with steel structures before the close of 1893. The wood trestles have also been replaced by steel, and the present and prospective low price of the latter material renders the cost of structures built exclusively with it not materially greater than if made of wood. The cheapness with which low-grade tracks can be operated is also receiving the attention of railroad officials, and nearly all the large corporations whose lines radiate from here are discussing the necessity of lowering their grades wherever possible. 'General Manager Merrill, of the Burlington system, in speaking of the advantage of low grades, said: 'I consider the measure more important that the introduction of very large engines. The fact that the Lake Shore & Michigan Southern is able to earn good dividends and at the same time make heavy outlays for maintaining the physical condition of the property on such a high standard, is largely due to the reduction of its grade during the last decade and a half. The saving in cost of track maintenance and motive power by lowering grades will also quickly pay for the work necessary to reduce the grades on most lines.' Another experienced railroad man was equally pronounced in favor of lowering grades, which he said when accomplished would enable the roads materially to enlarge their net earnings without any increase on the present tariff rates. He thought standard locomotives amply sufficient for the work, provided there was a lessening of grades, and that the large engines now coming into use were necessary only on the Eastern trunk and trans-continental lines, on which it is in many instances impossible to secure low grades. But he strongly favored the use of 80 to 85-lb. rails when tracks are renewed, also the displacement of wooden trestles and bridges with steel. He thought stockholders could afford to wait for dividends while such improvements were being made, as the future earning power of their property would be materially increased."

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The advances made in the last few years in the metallurgy of steel suggest possibilities that have heretofore hardly been imagined. The manufacture of armor plate of nickel steel, and the treatment of it by the Harvey process and by oil tempering, has resulted in a product so tough that it is very difficult to tool it, and we mentioned last week a nickel steel specimen which had been tested by pulling which gave, with 98,000 lbs. tensile strength, 42 per cent. elongation. A rail made of this kind of steel would be practically indestructible. It would also cost a good deal more than any chief engineer would dare recommend. Railroad directors would not be justified in considering posterity so far as to spend a company's money for such rails. But between a nickel steel, oil-tempered rail and the ordinary steel rail of commerce, there is a line of greatest economy which has not even been approximated in rail making.

The Advisory Board of the Western Traffic Association met in New York on Tuesday of this week, all the roads being represented except the Burlington, the Illinois Central, the Southern Pacific and the Great Northern. The only business done was to adopt the following resolution :

Whereas, The Chicago, Burlington & Quincy Railroad Company has given notice of its withdrawal from the Western Traffic Association, and such withdrawal has been followed by notices of withdrawal from other companies, which renders the Association ineffective. Resolved, That this meeting do now adjourn, for the reason stated, without date.

The Finance Committee will fix up the matter of Commissioner Walker's salary. This action doubtless means the death of the Association. As we have before remarked, the present is as favorable a time for a dissolution as could be found. The best of the smaller organizations are still as effective as heretofore, and they are in the hands of good men. They can keep the records, and that is one of the chief functions of a railroad traffic association nowadays. Records of the business of all the roads, in such shape that comparisons can be readily made, are a practical necessity in all territory where sharp competition exists, and the roads are ready to support a joint office for the purpose of accomplishing this. They might want to have those figures inspected once in a while. But as for taking any formal action, such as changing rates or diverting traffic, in consequence of such inspection—why, that is another matter! It is well to be always prepared to rightly prescribe a differential or to establish a pool, but as for actually doing those things—"not much."

The Superintendents' Society has again suffered from lack of enthusiasm. Enough subjects were on the docket to produce good discussions for two days, the report of the Signal Committee alone being sufficient to talk about for one day at least : but the members wanted to be somewhere else on Tuesday, so they stopped the meeting when it was only half done. The discussion on the catechism was the only feature of the meeting. This matter is in the hands of a good committee, and still more good work will doubtless be done. The *Railroad Gazette* has urged the value of a catechism many times. We fully appreciate the arguments of the opponents of the idea, but as long as one superintendent is responsible—or *feels* responsible—for the thoroughness of the examinations made by from 10 to 50 different subordinates, as is now the case on a number of large roads, the need of a guide, to secure something like uniform practice in asking questions, can hardly be gainsaid. Asking questions is a fine art, and fine arts are not second nature to many division superintendents and train masters. Moreover the general circulation of a list of questions among employés does not preclude written examinations. These have been successfully made on the Fall Brook road under the plan of having each individual write out his answer in the examiner's office, plenty of time being allowed, so as to remove all embarrassment. If one sitting does not allow time enough the blanks can be surrendered and locked up by the examiner. This plan is doubtless in many cases superior to a stenographic report of an oral examination. It was a mistake to refer the catechism to the American Railway Association, for it is yet susceptible of further improvement. The Executive Committee should print it in pamphlet form, and every member should test it in practice. They could then bring to the next meeting a large number of valuable suggestions for improvement in the phraseology of the questions.

We call attention again to the admirable article by Dr. S. W. Latta, Chief Medical Examiner of the Pennsylvania Railroad, which appeared in our issue of Sept. 23, and which laid down in considerable detail the precautions that railroad companies should take in time of cholera. We call up the subject again because the public, and especially the railroad companies, ought not to be allowed to sink into fancied security. In that article Dr. Latta said : "While it is probable we may escape a serious epidemic of cholera this fall, unless the strictest sanitary requirements are enforced all through the winter and spring, the dread disease will be a most unwelcome visitor next summer. Such is the teaching of history." The opinions which come from the other side of the water, from those who are in position to observe and judge, enforce Dr. Latta's warning. The very careful and well informed correspondent of the London *Times* says that the epidemic is steadily marching westward. He says that cholera is doing just what it has always done formerly—creeping quietly onward and sowing the seed now over a wide area which will burst forth with the coming of the next summer. This seed has been sown in the Black Sea littoral and the Danubian provinces. Austria and Hungary are involved, and the water ways from Berlin to the River Oder are infected. "If precedent is of any value all those districts and Poland and France will break out into a blaze in 1893. Cholera will knock at many doors and woe betide if there is a crack anywhere." The most competent medical opinion in this country, so far as we are informed, confirms this idea. A serious outbreak of cholera in Europe next spring would probably settle the World's Fair for one year at least. A serious outbreak in this country would certainly do so, and indeed, would be very likely to prevent its being opened for two years which would be the ruin of the enterprise, and the loss of the vast investments already made and of prospective earnings on the part of the railroad companies. In view of these great dangers the railroads, the best organized industry of the country, the industry which can most easily be brought to act in concert, and which if not very carefully administered, can do most to disseminate cholera, is the one which should take the lead from this moment in preparing to prevent its introduction at our ports or its spread inland if introduced. As showing the opinion of the American authorities on the invasion of cholera next summer, we quote the following from an editorial in the *University Medical Magazine*, of Philadelphia, for October :

"It is doubtful if the greatest danger to the American continent will be realized this fall. Probably the disease will not gain much of a foothold in this country at present. The real danger lies in the fact that in the spring there will exist far more favorable conditions for its spread, because of the approach of a season which gives it greater impetus, and still more because probably the dormant germs will be scattered throughout the different parts of the country, where they will have been carried by the immigrants coming through the fall and winter months. The whole country must be on the alert in the spring to seize and crush out the first appearance of the disease everywhere."

The work of the Committees on block and interlocking signal practice forms the subject of Colonel Haines' address before the Time Convention this week. We regret that we have had to condense the address somewhat. Col. Haines takes the same general view that was presented in these columns last week, but he emphasizes the well known fact that the Association does not undertake to define perfect methods or prescribe advanced standards, but merely to give form and authority to the rules of existing practice. And as no existing practice is sufficiently free from faults *and* widespread enough to command ready assent from the members, no standards can be recommended. We are not deviating from the lines indicated by Col. Haines, however, when we repeat that the Committee could do some good work by making a few vigorous reports. The establishment of standards, under the rules of the Association, may not be possible for five years yet, but to establish them even then will require a large amount of work between now and then, and there is a great need that this work be undertaken in the thorough fashion that was followed with the train rules. We have had much desultory discussion on signaling, but little that was comprehensive and vigorous. It must not be forgotten that, although few roads have done much in signaling and all are more or less inconsistent in their practice, we are by no means destitute of examples well worthy of study and of imitation in *most* of their features. A general survey may be discouraging, but a general survey is not the only means of gathering information and learning how to improve. Very complete interlocking plants can now be found at several places. The block signaling on some parts of some roads is almost perfect; perhaps, in a practical sense, quite so. The well qualified men on the Committee of this Association are the men to publish the virtues of this good practice among those who are contented with poor practice. We cannot say that this is a duty, as they are not servants of the public, but we remember that the good work of the Train-Rule Committee would not have been done if its members had not given up their time and energies wholly regardless of compensation or reward. If it shall be finally decided that the Association cannot consistently do this work, then the members are bound to make better use of the Superintendents' Society. The convention did considerable business besides listening to Col. Haines, though it sat only about three hours. The most important was the establishment of a penalty of a dollar a car for diverting foreign cars. As this was adopted without much discussion it remains to be seen how fully the members intend to carry out the rule. It cannot be enforced, of course, against any road that does not agree to the regulations, and a good many men of experience believe that these will develop so much "internal resistance" as to make them of little value.

Fares to New York During the World's Fair.

The New York newspapers recently have had much to say on the desirability of low fares to New York during the World's Fair next year, and incidentally have criticised the policy of the railroads in limiting to five days the excursion tickets to New York for the Columbus celebration this week. They say that if there are reduced fares to Chicago during the World's Fair, and not to New York, the throngs of people who go to Chicago will spend their money there, whereas if they can get to New York cheaply, they will save some of it to spend here.

But the situation of New York will not be peculiar. Boston, Baltimore, Cincinnati, Indianapolis, Milwaukee, St. Louis and most other cities will find that many who usually visit them and buy goods of their merchants will be able to go to Chicago next year for less money : and with the attraction of the exhibition this is sure to bring to Chicago a considerable amount of retail trade and probably some wholesale trade which is usually done elsewhere. If the railroads are, so far as in them lies, to maintain the relative equality of the several cities, either they must make no reductions in World's Fair rates, or they must reduce all rates in the same proportion. And yet if they should adopt the latter policy, and make, say a reduction of one half in all fares next year, they would probably injure and displease as many merchants as they would benefit and please. For the man who makes the exceptional trip of his lifetime to Chicago or New York next year, and buys his goods there, buys no more goods than if he staid at home. The trade which the New York or Chicago merchant gains, the traveler's home merchant loses, and the railroads must consider the interests of Utica and Elmira and Harrisburg, of Oshkosh and Peoria and Terre Haute, and even the interests of the little towns that we can't find on the map, as well as those of the great cities. The aggregate of the interests of the small towns and cities, in fact, greatly exceeds those of the few great cities.

Any great and sudden change in the relative fares to different trading centres disturbs trade to a greater or less extent. We have known the business of a town of 10,000 inhabitants very seriously injured one summer by a series of excursions, which that summer for the first (and last) time gave the people an opportunity, almost every week, to visit the city for about one-third the ordinary fare. But this is a risk a business man must take, like the risks of other changes in prices, and he cannot complain of them if the special fares are otherwise justified, as when opportunity is offered of greatly increasing travel thereby.

During the World's Fair there will doubtless be an extraordinary traffic on all the lines leading to Chicago. It is a serious problem for many of these roads how to provide facilities for this travel without making unjustifiably large investments in rolling stock which will not be needed after the Fair is over. Will it, then, be wise for them to make special efforts to stimulate other travel just at the time when they are most pressed with Fair travel? Shall the New York Central, for instance, just at a time when all its cars are crowded with New Yorkers going to and returning from Chicago, offer especially low rates to induce people from Texas, San Francisco, Salt Lake and St. Paul to visit New York. *If* the railroads have any superfluous facilities in Fair time, it may be worth considering; but the prevailing opinion seems to be that there will not be many empty seats in trains between New York and Chicago next summer.

It is doubtful if a low rate to New York would be as effective next year as in most other years, in attracting visitors to that city. The great bulk of the visitors to the Exhibition will be people who have to think twice before spending what a pleasure trip to New York would cost, even at half fares. They will have already made an unusual expenditure for their visit to Chicago. Probably tens of thousands of people in this country are now, and for some time have been, saving money for that visit to the World's Fair. These people not only cannot be tempted by the low fares to make additional journeys, but they will, many of them, economize in their other expenditures for the year. The other cities are not particularly anxious for the visits of these people because they would spend very little money. Still, there will be, without doubt, a great many visitors to Chicago who will be very well able to extend their journey to the seaboard and do a good deal of trading when they get there. How many more of this class will visit New York at a $10 than at a $20 fare? A considerable number, doubtless; but, there needs to be a very great number to warrant such a reduction, even if there were cars to spare.

The New York newspapers speak as if there was discrimination against that city in railroad fares. We do not see what foundation there is for such a charge. After more than twenty years' close observation of the course of railroad fares, we should say that New York and the adjacent seaboard cities have had a greater advantage from specially low fares than any other cities in the country. Excursion rates to New York have been on the same basis, usually, as to other places; regular rates to it and the other Eastern cities are the lowest first-class fares in the world, and there have been many long periods when the quarrels of the railroads have very greatly reduced them. We cannot see why anyone should think that New York fares worse than the rest of the country, unless it is that absurdly low rates have been made elsewhere, on occasions like those to the Denver conclave, more recently than to New York. But rates like those, which no one pretended to be profitable, should not be considered in a serious discussion of a proper rate policy.

The Six Old Chicago Railroads.

II.

We showed last week that the six old Chicago railroads (Milwaukee & St. Paul; Northwestern; Burlington & Quincy; Rock Island; Chicago & Alton and Illinois Central) in the aggregate had an increase in in capital stock and funded debt from 520 millions in 1882 to 735 millions in 1888 and 802 millions last year; while their income, which was over 48 millions in 1882 fell to 35½ millions in 1888 and last year was but 49 millions, which is only $975,000 more than in 1882. Let us now consider each one of the companies separately.

CHICAGO, MILWAUKEE & ST. PAUL.

	1891-92.	1882.	Increase.	P. c.
Miles	5,721	4,520	1,201	25.5
Stock	$70,392,161	$44,351,744	$26,040,417	58.8
Bonds	123,199,000	89,635,500	36,563,500	37.4
Millions of:				
Ton-miles	2,266.0	945.3	1,320.7	139.0
Pass.-miles	270.8	200.8	70.0	34.9
Gross earn.	$32,283,508	$21,285,726	$11,896,872	55.4
Expenses	20,815,004	12,186,073	8,628,931	70.8
Net earnings	11,468,504	8,200,653	3,267,851	40.0
Other income	237,354	623,814	(Dec.) 386,460	.....
Charges	7,274,150	4,785,053	2,489,097	52.0
Profit	$4,431,708	$4,038,414	$393,294	9.7

This company's great increase in mileage was nearly all made before 1887, when it already had 5,670 miles of railroad. That is, it stopped building about the time of the greatest activity in construction among its neighbors. At the close of 1887 its capital had risen to 180¼ millions, or 46½ millions more than in 1882, and in 1887 its income was the smallest for many years. The change in the capital and income for the last six years, compared with 1882, are shown below:

Stocks and bonds.	Income.	Stocks and bonds.	Income.
1882..$133,987,000	$8,824,467	'88-89..$184,507,000	$9,152,635
1886.. 164,118,000	10,342,254	'89-90.. 185,294,000	9,471,931
1887.. 180,513,000	7,708,551	'90-91.. 192,331,000	9,546,149
1888.. 180,716,000	9,099,952	'91-92.. 193,591,000	11,705,858

Thus the great additions to the property, which had been mostly completed in time to affect the business as early as 1888, resulted in a very small increase in income until last year. In none of the four years previous was the income more than $650,000 greater than in 1882, though the capital was from 46 to 58 millions greater. Its "new road" is now substantially all as much as seven years old. But the costly line to Kansas City has had its traffic greatly limited by the construction of two other new lines to that place.

CHICAGO & NORTHWESTERN.

The mileage worked directly by this company has increased 995 miles since 1881-82; but all but 95 miles of this increase was made before 1888. Very much larger additions to its system have been made through its controlled lines, the St. Paul & Omaha and the Fremont, Elkhorn & Missouri Valley, whose capital, earnings, etc., are not included in the following table. The large investments of the Northwestern in these companies swell its capital, which therefore must not be compared with its mileage.

CHICAGO & NORTHWESTERN.

	1892.	1882.	Inc. or dec.	P. c.
Miles	4,272	3,278	I. 995	30.4
Stock	$61,389,053	$37,338,501	I. $24,050,552	64.7
Bonds	114,235,500	64,248,000	I. 49,987,500	71.0
Millions of:				
Ton-miles	2,246.3	1,192.2	1,054.1	88.3
Pass.-miles	336.9	205.6	.....	64.0
Gross earn.	$31,422,272	$23,684,656	I. $7,537,616	32.7
Expenses	20,386,438	12,639,634	I. 7,696,804	61.0
Net earnings	11,085,834	11,045,022	I. 40,812	0.4
Other income	317,736	.....	.....	.....
Fixed charges	6,483,383	5,666,947	I. 816,438	14.4
Profit	4,920,185	5,378,075	D. 457,890	8.5

The capital covers immense investments in other railroads, and $7,675,000 of stock was issued last year for the purchase of Milwaukee, Lake Shore & Western stock too late to receive any dividend on the latter stock in the last fiscal year.

The Northwestern had substantially the same net earnings last year as in 1882, and, charges having increased meanwhile, its profits were about one-twelfth less than then. As is well known, it has maintained its dividends better than any of the other Chicago companies except the Chicago & Alton, which is due partly to having sustained smaller losses and partly to the large surplus of profits over dividends which it formerly had nearly every year.

The stock and bonds and income of the Northwestern have been as follows:

Stock and bonds.	Income.	Stock and bonds.	Income.
1881-82.. $101,586,500	$11,045,022	1889-90.. $158,678,500	$10,100,471
1886-87.. 151,077,500	11,250,973	1890-91.. 165,281,016	9,762,253
1887-88.. 157,126,500	10,026,759	1891-92.. 175,641,382	11,403,570
1888-89. 158,814,500	9,664,972		

Two-thirds of the increase in capital was made before June, 1887, and the income then was about the same as in 1881-82 and last year. It, however, in no one of the years since 1886 has fallen off as much as on some of the other railroads.

CHICAGO, BURLINGTON & QUINCY.

Compared with 1882, the changes are:

	1891.	1882.	Inc. or dec.	P. c.
Miles	5,285	3,229	I. 2,056	63.7
Investments	$32,961,806	$25,593,069	.....	.....
Stock	76,394,905	62,649,697	I. $13,745,208	22.0
Bonds	114,431,481	68,648,050	I. 45,783,431	66.7
Millions of:				
Ton miles	1,805.0	1,222.8	I. 582.2	47.6
Pass.-miles	289.3	178.3	I. 111.0	62.2
Gross earnings	27,916,128	21,550,805	I. 6,365,323	29.6
Expenses	18,549,258	11,283,963	I. 7,265,295	64.4
Net earnings	9,366,870	10,266,842	D. 899,972	8.9
Other income	1,528,473	1,782,224	D. 253,749	14.2
Charges	6,812,385	4,663,003	I. 2,149,382	46.1
Profit	4,082,960	7,386,043	D. 6,303 082	44.7

This company has added more than any other to its mileage since 1882, and the above does not include the controlled Chicago, Burlington & Northern. Most of its additions have been in Iowa and Nebraska. The traffic has not increased in proportion to the mileage, a great deal having been diverted by new lines, especially by the Chicago & Kansas City line of the Atchison. The gain in gross earnings, nevertheless, has been considerable, but less than the increase in expenses, leaving a considerable decrease in income, and an enormous decrease in the profit over interest on bonds, etc. The capital and income have been:

Stock & bonds.	Income.	Stock & bonds.	Income.
1882..$131,297,747	$12,049,066	1889..$183,240,794	$10,654,072
1886.. 155,926,233	13,098,838	1890.. 187,853,988	9,990,738
1887.. 167,665,213	12,904,303	1891.. 190,826,386	10,895,345
1888.. 176,039,494	5,484,835		

We remark again that this company's last fiscal year is less favorable than that of any of the other companies (except the Chicago & Alton) here mentioned, because it ends too early to have the full benefit of last year's great crops. The immense reduction in 1888 was of course due in large part to the strike.

This company's mileage has increased since 1887 much more than that of the two companies discussed above, an addition of 630 miles having been made during the last four years. A considerable part of the new mileage is north of the Platte River in Nebraska and Wyoming, where it competes chiefly with the Northwestern. The increase in capital since 1887 has been large also. This company down to 1888 was perhaps the most prosperous in the country, and had invested some 25 millions of profits in additions to its property.

CHICAGO, ROCK ISLAND & PACIFIC.

Until 1887 this company limited its operations to the east side of the Missouri. At that time the immense systems of the Union Pacific and the Atchison were entirely west of the Missouri, and companies like the Rock Island and the Chicago & Alton secured a considerable part of the traffic to and from these trans-Missouri systems. They were threatened with the loss of the Atchison traffic by that company's new line to Chicago, and the Rock Island built a considerable system immediately in trans-Missouri territory, a little in Nebraska, but chiefly further south.

The comparison with 1881-1882 is as follows:

CHICAGO, ROCK ISLAND & PACIFIC.

	1891-2.	1881-2.	Inc. or Dec.	P.C.
Miles	3,456	1,355 Inc.	2,091	153.2
Stock	$46,156,900	$41,960,000 "	$4,196,000	10.0
Bonds	55,352,000	17,590,000 "	37,852,000	216.0
Millions of:				
Ton-miles	1,697.2	788.5 "	378.7	48.0
Pass.-miles	218.9	113.9 "	105.0	92.0
Gross earnings	18,690,075	13,266,643 "	5,423,432	41.0
Expenses	13,147,057	7,322,862 "	5,825,195	79.5
Net earnings	5,543,018	5,943,781 Dec.	400,763	7.7
Other income	122,200			
Charges	3,731,989	1,402 912 Inc.	2,329,077	16.6
Profit	1,933,229	4,540,869 Dec.	2,607,640	57.4

There was subtantially no change in mileage until 1888, and though the gross earnings fell off a million from 1882 to 1883, there was little change in them thereafter until 1890, when the trans-Missouri system was absorbed. As to the net earnings, they declined almost continuously from the $5,943,781 given above for 1881-82 to $3,713,839 in 1888-89, and with the addition of the 1,900 miles since have ranged from $5,164,000 to the $5,543,000 of last year—never equal to those of 1882, and but little more than those of the three following years, when they exceeded $5,000,000 every year.

The capital and income have been:

Stock and bonds.	Increase.	Stocks and bonds.	Increase.
1881-82....$99,460,000	$5,943,781	1889-90....$95,943,000	$5,500,934
1886-87.... 71,320,000	4,814,240	1890-91.... 97,308,000	6,375,152
1887-88.... 87,616,000	4,766,667	1891-92....101,508,000	5,065,219
1888-89 .. 93,876,000	3,713,831		

The income in 1889-90 and the following year was increased by about $1,200,000 each year received as interest on the Chicago, Kansas & Nebraska bonds held by the Rock Island. The mortgage has been foreclosed and the Rock Island now owns directly the trans-Missouri roads. The net earnings were about 10 per cent. larger last year than the year before. The capital is $30,000,000 (42 per cent.) greater than in 1886-87; the income $851,000 (18 per cent.) greater. The bonded debt formerly was very small, and in 1886-87 prior charges absorbed only about one-third of the income. The great increase in the interest charges is the cause of the great decrease in dividends. The company's large investments in the Burlington, Cedar Rapids & Northern yield it no direct income.

THE CHICAGO & ALTON.

This is the most distinguished of all the Chicago railroads, from the fact that it has made no additions to its mileage for the past 10 years. The comparison with 1882 is therefore very interesting. Considerable improvements to the property and additions to its equipments have been made.

CHICAGO & ALTON.

	1891.	1882.	Inc. or dec.	P. c.
Miles worked	850	850	.....	.....
Stock	$17,594,300	$14,930,072	I. $2,664,428	11.1
Bonds*	14,812,850	11,437,850	I. 3,410,000	30.0
Millions of:				
Ton-miles	547.5	474.8	I. 72.7	15.0
Pass.-miles	112.5	101.2	I. 11.3	11.0
Gross earnings	$7,590,881	$8,215,495	D. $624,614	7.6
Expenses	4,458,750	4,684,508	D. 225,758	4.8
Net earnings	3,132,131	3,530,992	D. 398,861	11.3
Other income	27,566	337,047	D. 59,980	18.0
Charges	1,573,891	1,968,280	D. 394,379	20.0
Profit	$1,830,837	$1,895,309	D. $64,472	3.4

*And guaranteed stock.

The changes in stock and bonds have been made chiefly by issuing its own securities for those of leased lines, and in this way charges which were formerly rentals have become dividends. The gross earnings of the road exceeded $8,000,000 yearly, and averaged $8,450,000 for the six years from 1882 to 1887; since then they have averaged $7,420,000. The net earnings averaged $3,556,000, and varied but little for the first six years; and were from $2,684,000 to $3,132,000 in the last four years, averaging $2,901,000, or $655,000 (18 per cent.) less than for the earlier period. This result is especially interesting, because it has not been effected by a vast mileage of new road in a

territory unlike that formerly occupied, as is the case with all the other old companies. They have been affected by what they themselves have done as well as by what their neighbors have done; the Chicago & Alton only by what its neighbors have done and the general growth of population and production in its territory. It is noticeable that the freight traffic was but 15 per cent. and the passenger traffic but 11 per cent. greater last year than in 1882, which is a slow rate of growth for a Western railroad; but the increase in competition makes it easy to understand. The traffic reached its maximum in 1887. Last year passenger traffic was 6 per cent. and freight traffic nearly 15 per cent. less than then. The changes in capital have been insignificant since 1886. The income meanwhile has been:

1886.	1887.	1888.	1889.	1890.	1891.
$3,682,338	$3,940,442	$3,116,632	$3,218,756	$2,957,251	$3,404,698

The fluctuations have been less than on most of its neighbors; and, as is known, the old rate of dividend (8 per cent.) has been maintained; but recently there has been very little to spare, and in 1888 and in 1891 the surplus of previous years was drawn upon to make out the dividends, while formerly there was a considerable surplus yearly.

ILLINOIS CENTRAL.

	1891-92.	1883.		Inc. or Dec.	P. c.
Miles worked	2,884	1,928	I.	956	49.5
Stock	$45,000,000	$29,000,000	I.	$16,0 0,000	55.2
*Bonds	63,218,000	38,145,000	I.	25,073,000	68.3
Millions of:					
Ton miles	1,411.4	604.6	I.	806.8	133.4
Pass.-miles	208.8	113.3	I.	95.5	84.3
Gross earnings	19,291,760	13,064,743	I.	6,227,017	47.7
Expenses	14,070,020	6,995,251	I.	7,074,769	101.1
Net earnings	5,221,740	6,069,492	D.	847,752	12.3
Other income	974,771	500,235	I.	474,536	95.0
Charges	3,932,105	2,880,288	I.	1,051,817	36.5
Profit	2,264,406	3,689,439	D.	1,425,033	38.6

* Including guaranteed stock.

We compare with the year 1883, rather than 1882, because the company began working its Southern system, now a large part of the whole, in 1883. It appears that while the mileage has increased one-half the traffic has more than doubled, but the gross earnings have increased less than one-half. Meanwhile the working expenses have doubled, with the result that net earnings have fallen off one-eighth. To pay interest on the additional 25 millions of debt requires little more than a million, and the stockholders' profits have been reduced three-eighths. By 1882 the funded debt of the old company had been nearly all liquidated from the proceeds of the land grant, and the capital of the company was very much less than the cost of its property. The larger part of the company's new lines is in the South, chiefly in Mississippi, but it has new lines also in Northern Illinois (where they are very closely elbowed by other roads, old and new) and in Northwestern Iowa. More than half its additions to mileage have been made since 1887. The gross earnings varied comparatively little from 1883 to 1888, but have grown very rapidly since. The net earnings, however, were no larger last year than when the gross earnings were $6,000,000 less. The income, including that from investments, has been:

1888.	1887.	1888.	1889-90.	1890-91.	1891-92.
$6,569,729	$5,454,851	$4,793,075	$6,059,806	$6,318,513	$6,196,511

Thus this company, operating largely in a different field from the other Chicago railroads, has had an experience similar to theirs. In spite of large additions to its property and its capital, its income fell off largely from 1883 to 1888, and has increased by an important amount since, but not so as to yield an additional sum for the increase in capital.

It is pretty clear from the above that these six Chicago railroads have suffered greatly from the enormous increase in railroad mileage in their territory, a very large part of which they have built themselves. One can almost say that the companies which have built most have suffered most, and, perhaps, if we should say that those who have built most since 1886 have suffered most we should be near the truth. But there is another point to consider: most of these railroads in the old days were making very large profits. Now capital invested in railroads, under the conditions which exist in this country, is, on the whole, closely subject to the circumstances which govern capital in general: in the long run it is not likely to receive a greater interest than the ruling rate for other investments liable to similar risks. Not but that here and there a railroad investment may make large returns permanently, but that this is not likely to be possible for the great bulk of railroad investments in an extended territory.

The traffic officers both of the lines in the Trunk Line territory and of those in the Central Traffic Association have held consultations during the past week on the question of passenger rates to and from Chicago during the World's Fair, next year, and their deliberations have excited a good deal of comment among the newspapers. The New York papers have been much exercised over the alleged necessity of getting the roads to make excursion rates which will induce people to visit New York as freely, during the time of the fair, as they will go to Chicago. In other words, the Atlantic Coast Line ought, in their view, to make a rate from Savannah to Chicago via New York at as low a rate per mile as by the direct route; and for people west of Chicago it is demanded that excursion rates from Chicago to New York and back shall be made as low as those from New York to Chicago and back. We have discussed this phase of the question in another column. The more general complaint is, however, at the small reduction which the railroads propose to make from regular rates to Chicago. All the principal roads seem to be agreed that 25 per cent. reduction, or, possibly, 33 per cent., is all that they ought to make. This would make the round trip fare from New York to Chicago by the strong lines $30, or at the lowest $27. While it is too early to discuss the merits of this question in detail and the probable outcome of the discussion, it is fair to remind the public, especially the people of Chicago and the rest of Illinois, that the alleged reason for the present action of the railroads is doubtless the real one, and that it is a very good reason. It is, in short, that one-way tickets at the reduced rate cannot be afforded and are not due the public, and that round trip tickets are pretty sure to be scalped at Chicago; that is, the non-transferable clause in the contract is quite likely to be violated. It is true that theoretically a railroad need not have its tickets scalped unless it wishes to, but practically the most honorable company is quite helpless in the matter, and is justified in avoiding the use of round trip rates much cheaper than the one-way rates on such an occasion if it can.

The Cleveland Car Service Association, which includes the territory in and around Akron, has informed consignees that the manager of the Association, instead of the respective local freight agents, will hereafter take charge of car service matters in the Akron district, a very courteous notice to that effect having been issued, signed by the four railroad companies doing business there. As Manager Simmons' headquarters are in Cleveland, it is to be assumed that he will have to have an assistant at Akron. The meaning of this is, of course, that to maintain the requisite impartiality, while strictly enforcing the rules for charging demurrage, it is necessary, at a strong competitive point, to put the whole business into the hands of one man. To put it the other way, demurrage rules are very hard to enforce at a competitive point where the business is too small to warrant the maintenance of an independent office. This difficulty is largely irremediable, for demurrage must always be a secondary matter, more or less influenced by competition in rates; but it should be remembered that a demurrage association is not necessarily unprofitable because the salary of the manager exceeds the amount of his collections. It is profitable to keep cars out of the warehouse service, even at some direct expense, and this is true to a considerable extent even in dull times. Consignees must be trained in reasonable habits then, so that they will not be unreasonable when cars are scarce.

There will be some dull times, of course, during the six months of the fair. It is hardly to be expected that the railroads will fill all their passenger cars every day during the whole six months. If these dull seasons are atall prolonged—that is, if they last last more than a week or two at a time—it is quite likely that large reductions will be made, and that one way tickets will be sold at low rates. It is said that the Canadian lines are already making contracts in Europe to carry people from Montreal to Chicago and back at half rates. This will, of course, have its influence on American lines. Unless the extra volume of traffic keeps up with great regularity, this influence will probably be quite marked. The Erie, it is understood, already favors selling one way tickets at as low rates per mile as those charged for the round trip. It is to be hoped that secret cutting and all unpleasant strife will be avoided, but if the ordinary disturbances due to a lack of passengers on the weaker lines shall appear, it will undoubtedly be best to adopt the simple remedy suggested by the present proposition of the Erie officers.

The Midvale Steel Co. has cast a roller path bearing for an 8-in. disappearing gun carriage for the United States army, weighing 7,995 lbs. This is a remarkable casting, not only in point of weight, but in the nature of the material. The specifications called for a tensile strength of 65,000 lbs. per square inch, with an elongation of 20 per cent., with a minimum tensile strength of 55,000 lbs. per square inch and a minimum elongation of 15 per cent. The official test of this casting showed the tensile strength to be 73,000 lbs. per square inch, with an elastic limit of 35,000 lbs. per square inch and an elongation of 33.2 per cent. and a contraction of area of 47.18 per cent. The test bar was .5 of an inch in diameter and 2 in. long between measuring points. This is one of the most remarkable steel castings ever made, and the tests prove that cast steel when sound can be relied upon to be stronger and tougher than wrought iron and better adapted to resist shock. Of course, the difficulty is to get the castings sound; but for all ordinary purposes where forgings are generally used, such steel castings as this are more reliable than a forging, particularly if the forging is one having welds.

The Chicago Society for the Prevention of Smoke has accomplished one very desirable result, that of making the use of anthracite coal compulsory for tugs running on the Chicago River. This step has greatly decreased the smoke on the river front, and has had quite an appreciable effect on the color of the sky. It having been reported that there are some delinquents who are still using soft coal, this society has had its whole force of inspectors patrolling the river for some time. Every case of a smoking steamboat or tug, except those doing a lake business, is noted, evidence taken and warrants sworn out for the arrest of the owners.

Some Disputed Points in Railroad Bridge Designing.

The paper by Mr. J. A. L. Waddell, M. Am. Soc. C. E., under the above title, appeared in the February-March, 1892, number of the *Transactions* of the Am. Soc. C. E., and with the very valuable discussions made a volume of 186 pages. Altogether it is a distinct addition to bridge literature, and the influence of it has, no doubt, only begun to be felt. The changes in practice that Mr. Waddell seeks to bring about may not be made just as he wishes to have them made, but we have little doubt that the papers and discussions so far published will be fruitful, not only in further enriching the literature of the subject, but in actual practice. Therefore, we have asked Prof. Wm. H. Burr, now of the Lawrence Scientific School, Harvard University, to make an abstract of the paper and discussions, presenting the best of their substance in more compact shape than it appeared in the *Transactions*. All that follows is Mr. Burr's work:

MR. WADDELL'S PAPER.

The object of the paper is to induce the members of the Society and other interested engineers to discuss in a complete manner some open points in bridge design and the proper moving load for future structures, to the end, if possible, to attain uniformity in the matter of moving loads at least. Briefly, Mr. Waddell advocates the following:

A.—A set of six standard locomotive and train loads denominated classes Z (lightest), Y, X, W, V, U (heaviest). Each standard consists of two consolidation locomotives and tenders, followed by a uniform train load, with wheeled spacings in even feet. The total wheel base in each case is 104 ft. from front pilot to the front end of the train.

Class Z has 96,000 lbs. on a driving-wheel base of 15 ft. and a uniform train load of 3,000 lbs. per linear foot, while Class U has 156,000 lbs. on the same driving-wheel base of 15 ft. and a uniform train load of 4,000 lbs. per linear foot. The other classes have weights intermediate between the preceding. Instead of using these concentrations for actual truss computations he strongly advocates six systems of uniform loads for each different length of span, each of which will produce a maximum bending moment for any given length of span equal to that produced by the corresponding standard load of concentrations.

He would use these equivalent uniform loads for all lengths and types of trusses and girders, and offers to compute the entire setand present them to the engineering public if the proposed standards are adopted.

He computes the equivalent uniform loads for the class Z standard for spans ranging from 100 to 300 ft. in length, and shows that the "danger" variation from the same stresses produced by the concentrations does not exceed 2¼ per cent., while the safety variations are somewhat larger. He proposes a special formula for the vertical shear at the end of plate girders.

B.—*Wind Pressure.*—He recommends the usual 600 lbs. total per linear foot as a minimum, but for long spans would compute the pressures with intensities of 25 to 30 lbs. on actual projected surfaces. In order to find the latter he would double the area of one projected truss and deduct from the result that part of the leeward truss protected by the train, then add to the result the product of the span length by the vertical distance from the top of guard rail to bottom of stringer. He would also add the projected area of the lower laterals if they are exposed. He would compute both direct and overturning effect of the wind in all truss members. He would carry the entire upper chord wind loads, through the upper laterals and down the end posts, considering the feet of the latter pin ended for portal bending.

C.—*Styles of Trusses.*—He recommends plate girders up to 100 ft., single track lattice trusses 100 to 150 ft., and double track lattice trusses 100 to 125 ft., with pin trusses above the latter limit.

He would make all lattice trusses single cancellation, but would always exclude the pony truss, nor would he admit suspended floor beams.

He would use the Pratt truss for pin spans up to 250 ft., and the Pettit truss with inclined substrut above that limit, and believes that the top chord may be inclined or broken to advantage when the spans exceed 175 or 200 ft. He advocates increasing the clear width of single track roadways to 16 ft., and that for double track spans to 29 ft. He favors making maximum depth of span not greater than three times the distance apart

centres of trusses, and would always requires stiff lower laterals. He advocates a stringer separation of 8-ft. between centres with pine ties 8 in. × 12 in. on edge dapped, 1 in. on stringers and would use outer guard timbers 6 in. × 10 in. or 8 in. × 10 in. dapped 2 in. on ties which are spaced 14 in. centres. He would make the inner guard either a 5 in. × 4 in. × ½ in. angle iron, or a 6 in. × 6 in. timber dapped 2 in. on ties and faced on the sides toward the rails with a 3 in. × 3 in. × ⅝ in. angle iron; then bolt each end of each tie to the stringer flanges through the outer guards with ¾ in. bolts, and use the same bolts through the inner guard and alternate ties.

He prefers pine to oak for all floor timbers.

D.—*Working Stresses*—He does not think that the German fatigue experiments should govern the working stresses in truss members, but would allow for the effect of moving loads by using for steel eye-bars $12{,}000\left(1-\frac{1}{2}\frac{\text{min. stress}}{\text{max. stress}}\right)$; and for steel plates and shapes: $11{,}000\left(1+\frac{1}{2}\frac{\text{min. stress}}{\text{max. stress}}\right)$. For the lower flanges of plate girders he would use per square inch of net section 10,000 lbs. for spans over 20 ft., and 9,000 lbs. for spans under 20 ft.

For steel upper chords he recommends $11{,}000\left(1+\frac{1}{2}\frac{\text{min. stress}}{\text{max. stress}}\right)$, per square inch.

He strongly advises the straight line column formula, and for members subject to stress reversion he favors the form: $p=\text{constant}\left(1-\frac{1}{2}\frac{\text{min. stress}}{\text{max. stress}}\right)$ but would not apply it to railway floor beams carrying outer highway brackets, which very rarely produce a slight reversion.

E.—*Combined Stresses.*—In bottom chords he would add dead live and wind stresses and apply a unit stress 40 per cent. greater than that for dead and live loads only, but he would never exceed 21,000 lbs. for eye bars, or 19,000 lbs. for plates and shapes of steel. He believes that the bending in portal posts has never received the attention that its importance demands, and holds that for wind bending their feet must be considered pin ended. He would take the working intensity due to the combined dead live and wind loads (including the bending by the latter) from 20,000 lbs. for short spans to 24,000 lbs. for very long spans.

F.—*Plate Girder Proportioning.*—He does not like to make stringer webs less than ⅝ in. thick and would proportion end stiffeners, when the girders rest on abutment supports, for 8,000 lbs. per square inch and would make their ends closely fit the flange angles. The filling plates should be neglected in determining the section of end stiffeners. Inasmuch as the web must inevitably act to resist bending he would recognize its flange value by counting one-sixth of its sectional area in each flange.

G.—*General Details of Construction.*—This section cannot be fairly treated in the manner required by this condensed statement, but the main features are as follows: He would rivet stringers to floor beam webs in ordinary spans up to 175 ft., or in any draw span whatever; but in very long spans he would insert sliding joints in the floor system about 150 ft. apart. He would invariably use end floor beams for all spans, as giving great advantages in many respects, particularly for the motion due to expansion and contraction of the trusses. He would make all axes of bridge members, both main and lateral, which converge at a panel point intersect in a point. When ends of floor beams are cut away on a bevel to pass a chord, he would use an intermediate flange running the entire length of the beam. He would not countenance beam hangers with screw ends and would rule out suspended floor beams, except in subdivided panels. He calls attention to the bending effect produced by badly grouped rivets in a riveted connection.

DISCUSSION.

THOS. H. JOHNSON, M. Am. Soc. C. E.: Disagrees with Mr. Waddell and favors concentrated loads. He contends that they are simpler, more accurate and less laborious; also, that the true equivalent uniform load varies, not only in the length of span, but with its position on the span. The diagrams proposed do not entirely commend themselves to him, as he would make all train loads 4,000 lbs. per linear foot and change the spacing so that the drivers would be 4.5 ft. apart, with 11 ft. from rear driver to the front tender wheel. He thinks that properly designed pony trusses are permissible, as his experience has demonstrated their excellence. In subdivided panels he would not use the substrut, but carry the vertical load to the upper chord by a tie, for he claims that a tie and strut in the same line cannot act together. He deprecates the proposed formulæ for fixing unit stresses and considers them complex, as they require different values for different classes of truss members; he also asserts that Mr. Waddell's straight line formula is arbitrary in its constants and without support. Half through plate girders with long panels do not meet his approval.

THOMAS C. CLARKE, M. Am. Soc. C. E.: Advocates steel floors of plate with gravel filling. He is of the opinion that the assumption of the moving load being twice as destructive as the dead is safe and prudent until we secure more information relating to the effects of rapidly moving loads. He would use pin connections for chords, posts and diagonals, except in spans of less than 150 ft. and rivet all other connections.

GEORGE F. SWAIN, M. Am. Soc. C. E.: Believes that the labor of computation with concentrations is exaggerated by the author, although he favors uniform loading with a locomotive excess. He contests the views of Mr. Waddell regarding double web systems for riveted trusses, and holds that they contain features of construction which are of such merit as to far more than balance the disadvantages of ambiguity in trusses, at the same time claiming that even a single system pin truss with continuous upper chord does not exhibit perfect stress determination. He advocates plate hangers for floor beams when properly designed and with proper lower lateral connections, observing that when floor beams are riveted between posts, the upper rivets are subjected to tension and the chord is twisted. A floor with main stringers under rails, but with outer lines of guard stringers, is his preference. He thinks Mr. Waddell is inconsistent in regard to the fatigue of metals, because he really proposes formulæ based on it, and believes that it is unnecessary. He would add a proper percentage to the moving load and treat the result with the dead load, as all dead. His opinion is to the effect that the straight line column formula is wrong in form and practically no simpler than that of Tredgold. He believes that the end post feet, in computations for wind bending, are nearer fixed than rounded.

J. M. JOHNSON, M. Am. Soc. C. E.: Agrees with the author as to the desirability of abolishing concentrations, but would suffer them if uniformity could be secured. He believes that if general agreement is to be reached at all, it will be only in reference to loads, stress intensities, kind and quality of material. He also thinks that when steel is used in place of iron the maximum thickness of metal should be specified.

CARL GAYLOR, M. Am. Soc. C. E.: Would insist that the minimum thickness of metal should never be less than ⅝ in., and calls attention to the inaccessible surfaces in the joints of pin bridges.

G. LINDENTHAL, M. Am. Soc. C. E.: Agrees with Mr. Waddell as to the uselessness of concentrations, and gives his own practice as that of uniform load combined with one concentration equal to ten times the amount of uniform load per linear foot. The methods of analysis with concentrations should be well known and recognized, but he would not follow them in the usual routine of bridge designing. He claims that the lateral bracing is stressed more by the shocks of moving trains than by the assumed wind loads, and he maintains that satisfactory lateral connections in pin bridges are not yet secured. His preference is for a small number of eye bars rather than a large number of smaller ones, as being stiffer and exposing less surface to rust. He advocates buckle plate floors with stone ballast, as well as re-railing devices and collision jibs. He does not believe that fatigue formulæ should be used in bridge designing, because working stresses are so far below the elastic limit; but he is of opinion that the real safety factors of compression members are much below those for tension members. Hence he would specify a maximum value of $l \div 2$, of about 50. For long spans he would make working stresses matters of judgment rather than use hard and fast rules.

WM. H. BURR, M. Am. Soc. C. E.: Agrees with the author in his objections to concentrations, but does not concur with Mr. Waddell in advocating the equivalent uniform loads; but he would use the uniform train load with a concentration at its head or at any intermediate point, equal to the total excess of the locomotive and tender weights over an equal length of train.

He indorses Mr. Waddell's views on the use of steel, and comments on it as admirably adapted to the purposes of bridge construction. Without giving detailed rules, he is of the opinion that working stresses in steel may exceed those for iron by 20 to 25 per cent. He thinks well of stiffening end lower chord panels, but considers the lower ends of end posts more nearly flat than pin ended.

In his judgment, wind stresses in the lower chord may be neglected unless they exceed 15% those due to fixed and moving loads, and he would also neglect transferred truss and moving load wind stresses. The method of carrying upper wind loads through upper laterals direct to portals and down portal posts to masonry, meets his approval.

L. L. BUCLER, Am. M. Soc. C. E.: Would be glad to abolish concentration, but thinks the time is not yet ripe for it. Advance in American bridge engineering has been due to great detail in computations and investigations, and he thinks such are still needed. Multiple systems of triangulation in riveted spans meet his approval; and he would make all lower chords stiff up to 175-ft. spans. Mr. Waddell's argument against shallow eye bars for long panels do not appeal to him as well made, for he does not approve making the eye bar act as a beam to sustain its own weight. The nearer it can assume the catenary due to its own weight and the tensile stress upon it, without acting as a beam, the better. He regards the suspension of floor beams generally objectionable, although permissible in some special cases. Stringers placed 7 ft. apart centres and riveted to floor beam webs, with proper number of rivets, seem to him to meet all requirements. He believes that if live load unit stresses are small in comparison with those due to dead load, bridges will last the longer for it.

J. B. JOHNSON, M. Am. Soc. C. E., Concurs essentially with Mr. Waddell's views regarding the advisability of abolishing concentrations, and proves that a uniform load, giving the same bending moment as the wheel loads, will give almost the same truss stresses in all members as the concentrations. He gives a very interesting and valuable analysis of the combined tension and bending in eye bars, together with a table of depths for greatest fibre stresses due to bending from own weight in long panels of pin bridges and the fibre stresses themselves. He shows that these bending stresses will vary from 10 to 20 per cent. of the working tensile stresses for bars in lengths of 15 to 30 ft.

HENRY T. EDDY, M. Am. Soc. C. E.: Believes the paper is a move in the right direction and advocates a system of uniform wheel concentrations to be agreed upon and generally adopted. He claims that the author has misunderstood his own (Eddy's) paper and the object of it, and contends that he has given methods with concentrations equally simple and expeditious as those with uniform loads. His mathematics and analysis simply prove the accuracy of the methods and are not to be used in designing. He maintains that if his methods are used equivalent uniform loads are rendered unnecessary, as nothing will be gained.

(To be continued.)

Continuous Indicators.

BY W. H. BOOTH.

Certain remarks in the *Railroad Gazette* concerning the desirability of some means of continuously recording the power developed by a locomotive lead me to offer what follows on the subject of continuous indicators so far as they have come under my notice. The devices to which I propose to refer are merely such as are applicable to steam or other fluid worked engines, being, in fact, a combination of the steam engine indicator with an integrating motion and recording apparatus.

The first of these is known (or ought to be known) as Ashton & Storey's Power Meter. It is applicable only to one steam cylinder of a locomotive, and two meters, of course, would be required to give exact results embodying both cylinders. We may, however, assume with very fair approximation to accuracy that in a locomotive the total work done is deducible from the record of one cylinder by first taking ordinary diagrams from and finding the ratio of power developed in the different cylinders and figuring the total from this ratio. Better still, of course, would be two meters.

This first meter consisted of a small cylinder in free communication with the engine cylinder at each end and containing a light piston on the rod of which was a small fine edged steel wheel *C* (fig. 1). The travel of this small piston was perhaps two inches or less. At a distance from the piston equal to half the diameter of the small wheel was a smooth faced disc of gun metal carried on a horizontal spindle (the piston motion was in a vertical line). This disc was connected with the crosshead of the engine of suitable reducing gear and revolved to and fro in alternate directions with each stroke of the engine. The steel wheel, above named, pressed lightly on the face of the disc, and, when the cylinder was at atmospheric pressure, or at equal pressure at both ends, the disc centre point touched the wheel, but when steam was admitted to one end of the cylinder the wheel was carried across the face of the oscillating disc and caused to revolve by the contact of this. When central, of course, the wheel stood still; when above the centre the wheel revolved in one direction, and when below the centre it revolved in the opposite direction if the disc revolved continuously; but, as the disc changed its direction of rotation every stroke, the wheel revolved continuously in the same direction, for it crossed the disc centre just when the disc stopped and reversed its direction of oscillation.

The arrangement is sufficiently indicated in fig. 1. Now it is evident that the indicator or meter piston simply moves in obedience to the difference of pressure between the steam in the two ends of the engine cylinders, and the extent of movement is controlled by the helical spring in the usual way. Thus net forward pressure is usually measured by the meter.

It is very clear that the greater the net pressure in the cylinder, or rather, in one end, the greater the excess of pressure above that in the other end, the greater will be the motion of the meter piston, and therefore of the wheel *W*. This integrating wheel will be carried toward the rim of the disc *D*, and will be turned by the rolling contact of this through a greater angle than when it makes contact near the centre of the disc. Given then a spring of equal compression or tension for every pound pressure and the angular rotation of the integrating wheel will be exactly proportionate to the distance of the wheel from the disc centre; i. e., to the net effective pressure in the cylinder.

It only remains now to attach a toothed wheel to the piston rod extension and gear this with a long pinion *P* to be able to make a connection between the wheel and a dial plate, or series of dial plates *G*, like a gas meter index, and the exact number of units of work can be read off at sight which have been done since a given time. It only required a simple calculation of the ratio of the number of indicated units on the meter to the I. H. P. of the engine to find the actual horse power developed. Necessarily every engine has its coefficient, and it is advisable to so regulate the angular motion of the oscillat-

ing disc that the coefficient for the engine will be reduced to a single figure, if possible, to enable the observer to mentally work out the horse power at once from the index reading. Necessarily the connection between the engine and the disc should be positive and unstretchable or inaccuracy is inevitable in the readings.

This meter was used at sea on a voyage of some weeks, and attracted a good deal of attention; but it was invented too soon, and never much used. It was interesting to note its working on a colliery winding engine, for example, where the load was set to pull against the reversed engine; so pumping back air to the boiler, the meter index would turn back and substract from the recorded work done, as it properly should do. The net day's work would be shown on a locomotive running down grade, and reversed it would show the power pumped back if the wheels did not slip.

The fault of this meter I will shortly point out, and would merely add that, as made, each unit on the index represented 1,000 ft. lbs. on each circular inch of the piston. Thus the square of the diameter of the cylinder multiplied by 1,000 gave the total work in foot pounds.

Some few years later a new meter was invented by a Mr. Boys. In this meter a small brass cylinder was caused to slide to and fro along its own axis by a connection with the crosshead of the engine. As it thus slid to and fro it was in contact, like the disc of Ashton's meter, with an integ rating wheel, and this wheel was carried on a spindle nor mal to the cylinder axis and capable of being revolved through an angular movement of the action of steam on the meter piston. Fig. 2 gives a general idea of this meter. When the steam pressure was equal on both faces the integrating wheel would roll on the cylinder as this slid to and fro exactly parallel with the cylinder's axis; but any motion of the meter piston set the wheel, as in the figure, at an angle with the axis of the cylinder, and so the cylinder was revolved through an angle proportionate with the angularity of the wheel, *i. e.*, with the steam pressure causing such angularity. It is clear, however, that the range of action must be limited, for, given an infinite piston movement, and the wheel for an infinite power would be normal to the axis and could cause no revolution. In practice the angle would soon be attained at which the cylinder would slide under the wheel without receiving its due rotation. Hence, the necessity of keeping down the range of the meter piston—a necessity not found in Ashton's meter except as regards the diameter of the disc beyond the edge of which the disc must not travel.

Ashton's meter is the more practically good machine and has no limit beyond which it could not work, such as has the Boys meter, as above explained. I was well acquainted with Ashton, and first became aware of what he had done in this direction bydrawing his attention to Boys meter, and he pointed out what he considered to be the defects of the meter, especially in regard to the slipping of the integrating wheel by chattering, and he emphasized his argument by stating that his own meter was liable to the same fault, and drew attention further to the fact that as the wear on his disc was greater toward the central parts, this wore away quicker and the face of the disc became hollow, so that the wheel would in time pass over the face without making contact near the centre, and there was no registration of the lowest pressures in the cylinder near the end of the stroke. He then and there stated he would contrive a meter free from all such defects, and I believe he did so mentally before we parted; and, when he next came to see me, he had worked out the idea and soon put it into form; and fig. 3 is copied from a drawing made from the first meter constructed by him, of which the elements are as follows: A hyperboloidal frustrum, carrying a worm F on its inclined axis, is carried in a frame and drawn to and fro along two round guide bars G and H. A long roller C bears against the face of the frustrum and is moved up and down along the curved face by the action of the small steam piston of the meter controlled by the spring above. The roller C is kept pressed against the frustrum by a spring K shown. The worm on the frustrum spindle gears into a long pinion E, the teeth of which are not parallel with its axis, but portions of long pitched spirals wound about the body of the pinion.

The pitch of these spiral teeth bears such a ratio to the pitch of the threads of the worm F that when the roller C stands at the neutral position of no pressure any revolution of the conoidal drum can cause none of the pinion E. Any change in the height of C, bringing it upon a largeror smaller diameter of the conoid, necesarily changes the angular motion of this latter as it is drawn to and fro, and turns the long pinion E which is geared to the index train. In this meter there is, therefore, no really scraping motion of the integrating wheel (in this case a roller C) upon the surface of the piece moved by the engine crosshead.

Subsequent meters were made very much more neatly than this, but the principle was adhered to. The one illustrated was tried on an engine at a cotton mill in Manchester, and I remember that one day without apparent cause it began to reel off the work units on the dial plate at a quicker rate. No difference in machinery driven had been made, but a search revealed a heated neck in a concealed place which had added a very large percentage to the engine load.

During the last few years I have lost sight of Ashton and of the meter altogether, but your remarks led me to bring it before your readers as a valuable means of showing the power developed by a locomotive. No doubt it could be arranged to give a record of its index at every period of time, but it can be instantly read off at sight, and on a locomotive would show just the development

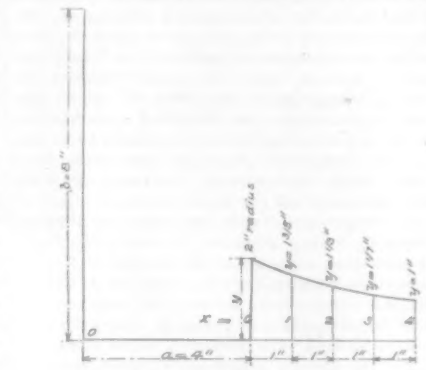


Fig. 4.

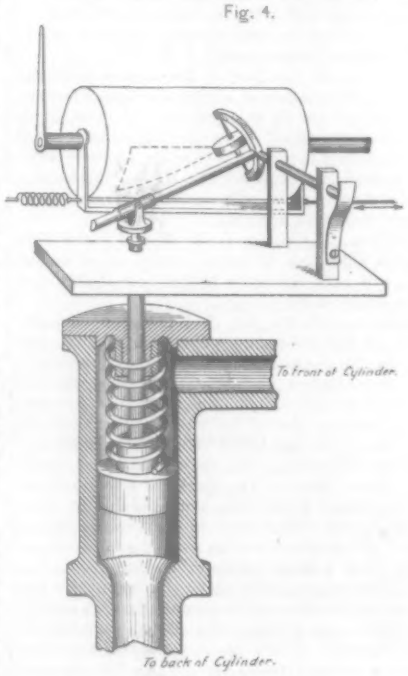
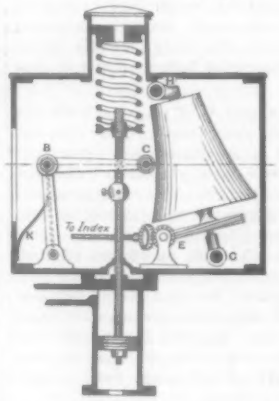


Fig. 2.



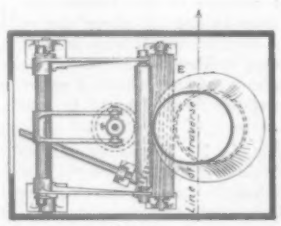


Fig. 3.

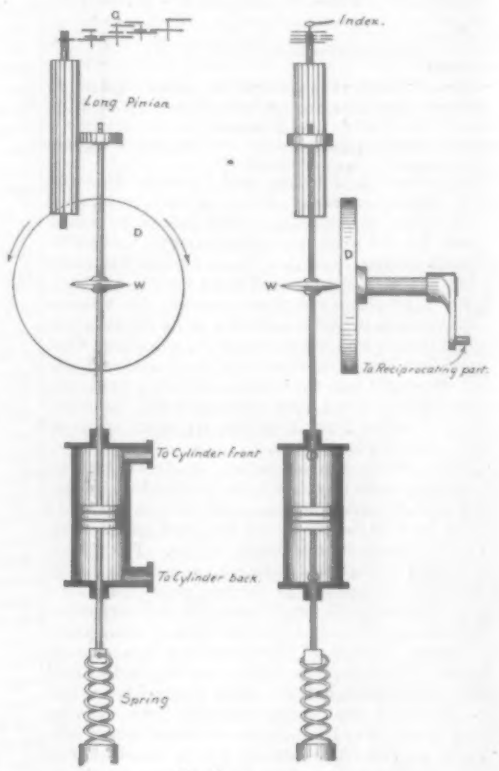


Fig. 1.

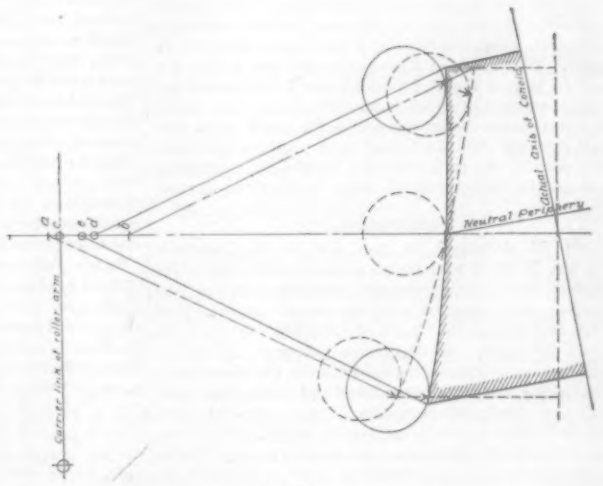


Fig. 5.

CONTINUOUS INDICATORS.

of power between the foot and top of any up-grade or between any two desired points.

In Asbton's first meter, so long as a spring of equal intervals was employed, the employment of an oscillating disc would always insure that the motion given to the integrating wheel would be exactly proportional to the distance from the centre or to the steam pressure. In the conoidal meter the drum might appear at first glance to require to be a plane frustrum. This point required to be decided.

Suppose the roller C at neutral position to be as shown on full lines at the middle of the drum, as in fig. 5. Let it be supposed that a pressure of 100 lbs. forces the roller over a distance of 1 in. from the neutral point; then we know that the ratio of the diameter of the drum at the top position of C to the middle diameter must be that of the middle diameter to the diameter at the lower position of roller C. If the drum were a plain cone and the neutral diameter 3 in., then if the diameter at 1 in. above this were 2 in., at 1 in. below the middle diameter it would be 4 in. The three diameters would bear the ratio 2 : 3 : 4 or 1 : 1½ : 2, whereas we require their ratio to be 1 : 1⅓ : 2. In the instrument as first made, the equation to the hyperbolic conoid referred to its asymtotes being $(a + x)\,y = b$, a and b being constant, values of these were selected as $a = 4$ in., $b = 8$ in. as in fig. 4, the base of the conoid being 4 in. from the origin o.

Then for values of $x = 1$ to 4 in., the sum of $a + x$ at each point becomes 5, 6, 7 and 8 in. respectively, and $y = \frac{b}{a + x}$ becomes $y = 2$ for $x = o$; 1⅔ for $x = 1$; 1⅓; 1½ and finally 1 in. at the narrower end where $x = 4$; the conoid being thus of flat curvature and, conveniently, with base double the diameter of the other end. Suppose at neutral position where the radius is 1⅓, the conoid when sliding along the roller C makes one revolution. Then when the roller is moved to the position where $y = 2$, the conoid will make only $\frac{1\frac{1}{3}}{2}$ or ⅔rds of a revolution per traverse.

If again the roller C move to the position where $y = 1$, *i. e.*, an equal distance to the other side of the neutral line, the angular motion of the conoid per conoid will be $\frac{1\frac{1}{3}}{1}$ or ⅓rds of a revolution. This is just double the angular motion given at the other end, and is as it should be.

The same elementary calculation may be made for any other positions on the conoid, and will show the proper proportional angular movement for each position of the roller C.

There are certain purely mechanical points which require attention and correction. The roller C has a measurable diameter, whereas theoretically the arm which carries it is supposed to make a mere knife edge contact with the conoid. In fig. 5 the dotted lines show the conoid set out with its axis normal to the neutral position of the roller arm, and the roller C is drawn at the arm end with an exaggerated diameter, and we see that whereas it appears to make no difference in the point of contact with the conoid at the large diameter of this, where the conoid is tangent to the roller, yet at the narrow end the point of contact is some $\frac{1}{16}$-in. too low, and this would give incorrect results. Further, the radius point of the arm is made to move to and fro excessively between a and b. Ashton therefore inclined the conoid so as to place its outline about tangent to the roller C at the middle or neutral position. This, as shown by the full line diagram, slightly changes the point of contact at the large end about $\frac{1}{16}$-in., but very much reduces the displacement at the small end.

This axial inclination does all that is so far possible to correct the mechanical error due to the roller. Obviously the final correction is to first find the inclination of axis which will most nearly balance the displacement of the contacts at the two extreme positions, and then set out the outline of a new hyperboloid by projection which will have at each point of contact of the roller the same diameter on which to roll as would make contact with a knife edge arm.

So far as the rough sketch appears to show in Fig. 5 a new conoid about one-quarter inch shorter than the theoretical one and of the same end diameters would effect the correction necessary. If uncorrected the conoid will turn through too great an angle when rolling on its larger end, and through too small an angle when rolling on its smaller end, for in each case the displacement of the periphery of contact is toward the neutral zone. Where both ends of a cylinder give an exactly similar diagram, the inclination of the axis alone so as to give each end an equal displacement of contact periphery would be all the correction necessary, as what was lost at one end would be gained at the other; and it seems that a small roller C about $\frac{1}{4}$ in. in diameter would require very little correction indeed, and in any case any want of absolute correction of the small fault could only affect results a small fraction upon the difference, if any, of the work done in the two ends of the cylinder. It is for this reason and the general working accuracy of this instrument that it ought to be better known, and I know of no field where it is more needed than in that of locomotive testing. It is obviously desirable as reducing to a minimum the errors due to uncorrected effect of roller diameter that the arm which carries C should be of such length that its extremity should describe an arc as closely approximate to the curvature of the face of the conoid as other conditions admit possible. The inclination of the axis has already reduced the oscillation of the arm centre from the amount $a\ b$ to the much smaller one of $c\ d$; and, if longer still, d and e would come closer to c. The axis of the conoid, too, needs slightly more inclination in fig. 5 than is there given to it, so that e and d may be made to coincide.

Though made to swing on an oscillating link, the back bearing of the roller arm ought correctly to slide to and fro in a straight line, like Scott Russell's parallel motion lever. Consistently with strength the usual requirements of a steam engine indicator need to be attended to, such as reasonable lightness of parts.

The following formulas were used in calculating one of the early meters made:

d = diameter of engine cylinder in inches.
l = stroke in feet.
t = traverse of conoid to and fro in inches.
n = number of springs in meter.
(This number is the number of pounds pressure which will move the roller C one-tenth of an inch.)
R = reading of dial.
r = any previous reading.
M = minutes of interval between R and r.

$$(R - r) \times 1{,}000 \times n \times \frac{l}{t} = x = \text{foot pounds of work per}$$

circular inch of piston in M minutes.

$$\frac{x \times d^2}{33{,}000\ M} = \text{mean indicated horse-power rate of work.}$$

As n, l, d^2 and t are all constant in one engine, we may

$$\text{put } \frac{n\ l\ d^2}{33\ t} = C$$

$$\text{and } \frac{(R - r)}{M}\ C = \text{horse-power.}$$

Thus the dial reading multiplied by $\frac{C}{M}$ gives the rate in horse-power, and the dial reading $\times\ C$ gives the horse-power between point and point. We may thus work out C and change t until C becomes a simple number and at once find the power by multiplying the dial reading by C without trouble.

From the foregoing it will be evident that the conoid and roller C have such movement relative to each other and on their own axis that there is no hindrance to a perfectly free motion. They each revolve as freely as a rolling wheel on a plain surface. For the rough work of a steam power meter involving a sudden piston movement, the importance of eliminating all such cross motions as those of a tangential integrating wheel is very great. For slow motions either Ashton's original or a Boys meter would act well, but the rapid forcing of the integrating wheels over a surface in a direction not parallel to the line of free rolling unfits them for steam engine work, especially as the rolling contact in such instruments has to drive an index. In the conoidal meter the conoid derives its angular motion by rolling directly along a round bar C, and contact may be firm and steady between the contact surfaces. In any meter it is advisable that a stop piece should be employed, to be set not above the range of movement for full boiler pressure, so as to act as a check against the customary excess of movement which follows a rapid steam admission. Indeed, such stops should be fitted to all steam engine indicators to check initial excess of piston motion, and would probably be found to reduce the waviness of lines so often noticed, especially in diagrams from locomotives.

TECHNICAL.

Manufacturing and Business.

The Bancroft Vestibule Car Co. has been organized in Illinois by George W. Bancroft, M. E. Cole and W. P. Tuttill.

The Boston & Maine has adopted the Marden steel brake beam, and in future will use it on all new equipment.

The Alton Construction Company has been incorporated by John G. Chandler, Charles Hodgman, James Adkins, H. G. Knapp and B. L. Crosby, St. Louis. The principal office will be in Colorado Springs, Col.

The Nuttall Railway Supply Co. has been incorporated by E. H. Harrison, P. H. Carey and E. A. Graatzinger.

The Burrowes Car Shade Co., Portland, Me., will furnish its automatic shades for 50 cars being built by the St. Louis Car Co. for the New Orleans & Carrollton.

A consolidation of brake beam manufacturing firms has been effected. The new company is called the American Brake Beam Company of Chicago, and the officers will probably be: H. W. Oliver, of Pittsburgh, Pa., President; C. A. Newcomb, of Detroit, Vice-President; E. I. Frost, of Chicago, Secretary, and W. A. Pungs, of Detroit, Manager. The companies included in the consolidation are the Michigan Railway Supply Company, of Detroit, who own the Central brake beam, Schoen Brake Beam Company of Pittsburgh, Northwestern Equipment Company of Chicago, controlling the Kewanee brake beam, and the Universal Brake Beam Company of St. Louis.

New Stations and Shops.

Plans have been drawn by George J. Metzger for the new shops for the National Car Wheel Works of Chicago, which are to be built at the new town of Depew, near Buffalo, N. Y.

The Pennsylvania is enlarging two of the buildings of its repair shops on the Hackensack meadows, near Marion, N. J., to accommodate a larger number of workmen.

Wilson Brothers & Co., of Philadelphia, have completed the plans for the elevated station of the Philadelphia & Reading Terminal, at Spring Garden street, Philadelphia. The new station is to be very similar to those at Eighteenth and Twenty-eighth streets, New York, on the Manhattan Elevated, which were designed by the same firm. Proposals for building the station have been invited.

The Fitchburgh has just opened a new passenger station at Malden, Mass., which cost $50,000. It is built of brick, with terra cotta and granite trimmings, and is finished inside with oak and white wood. The general waiting room is 40 × 110 ft.

The Jacksonville, St. Augustine & Halifax River road will build at once a six-stall brick roundhouse at St. Augustine, Fla.

The Great Northern is said to have finally decided upon the location for its proposed car shops at Spokane, Wash., and work will begin on the new buildings at once. The shops will give employment to about 300 men.

The proposed car shops at Houston, Tex., will be built, it is announced, under the superintendence of J. M. Sweet, of Boston, and J. M. Beale, of the Portland Car & Machine Works, and for many years its Superintendent. They state that the building will be completed in four months. Work will begin immediately on two buildings, 60×80 ft. and 60×120 ft. Orders for machinery have already been awarded. The buildings and machinery will cost $125,000.

The Philadelphia & Reading has decided to move its car and machine shops from Palo Alto to St. Clair, Pa., to gain increased track room at the former place.

Iron and Steel.

The annual meeting of the Pennsylvania Steel Co. was held last week. The usual six per cent. semi-annual dividend was declared, payable on Oct. 15. The following directors were elected: Luther S. Bent, Edmund Smith, H. H. Houston, William M. Spackman, Eben F. Barker, Charlemagne Tower, Jr., and Wayne MacVeagh. The following officers were elected: President, Luther S. Bent; Vice-President, Eben F. Barker; Secretary and Treasurer, Edmund N. Smith.

The Vienna-Budapest Electric Railroad.

The project of building an electric railroad, exclusively for passenger traffic, between Vienna and Budapest, first brought up in the early part of 1891, is again talked about. The Ganz Iron Foundry & Machine Works Co., of Budapest, which proposed the undertaking, has further developed its plans, and has again applied for authority from the government to begin the preliminary work. The road is to be about 155 miles long, and the running time between the two terminals is to be an hour and a half.

The Prince Edward Island Tunnel.

Mr. Alfred Palmer, the engineer in charge of the tunnel survey, says that the survey will be finished in about three weeks. Practically the work is completed now, but a few more borings will be made to make the survey as complete as possible.

The New York Air Brake.

The New York Air Brake Company sends us the following letter, which explains itself, and announces a decision of considerable importance:

New York Central & Hudson River Railroad Co.
NEW YORK, Sept. 26, 1892.

MR. ROYAL C. VILAS,
President New York Air Brake Co.:

Replying to your letter of last week, I would state that a full and detailed report from Mr. Dudley on the tests recently made by us of your automatic quick-acting brakes, will not be ready until some time in October. I have, however, a preliminary report from Mr. Dudley, and also reports from Mr. Voorhees, our General Superintendent, and Mr. Buchanan, our Superintendent of Motive Power and Rolling Stock, both of whom were present at the tests.

The gist of these reports is that, from a practical operating standpoint, there is no difference between the operation of the Westinghouse air brakes and the air brakes of the New York Air Brake Company; and the tests where the cars in the train were mixed, a portion being equipped with the brakes of one company, and a portion with the other, showed as good results as when either brake was used separately.

We are satisfied that there are no practical objections to allowing the cars equipped with the New York brake to be used in conjunction with those equipped with the Westinghouse brake. I have, therefore, issued orders removing all restrictions as to the use of cars equipped with your brakes; and, hereafter, cars so equipped will be received and operated by this company and treated precisely the same as the cars equipped with the Westinghouse brake.

H. WALTER WEBB, *Third Vice-President.*

The Fiske Range Finder.

The Franklin Institute Committee on Science and the Arts has recommended Lieut. Bradley A. Fiske's electric range finder for the Elliott Cresson gold medal.

New Street Car Traction Systems at Paris.

Mechanical traction systems for street car propulsion are being regarded with growing interest at Paris. Until within a short time ago the use of such traction system within the city had been forbidden, but now permission has been extended to put them into operation on several lines. The *Compagnie des Tramways de Paris* will try a new system of electric storage battery propulsion on three of its lines, and the experiments, it is thought, will give conclusive results. The storage batteries will be of the Laurent-Cély-Sarcia type, and the cars will each be provided with two 15 H. P. Gramme or Siemens electric motors. The cars are to be run at the rate of about 7½ miles per hour within the city limits, and at the rate of about 10 miles per hour after passing the city lines. Compressed air locomotives will be used by the *Compagnie Générale des Omnibus* on two lines. The McKarsky system will be adopted, having acquitted itself favorably on the several suburban lines which are now using it.

Iron Ore Shipments.

The shipments of iron ore from Two Harbors, Minn., to Oct. 5 were 953,132 tons, and it is probable that the total for the season will exceed 1,100,000 tons, as charters for 175,000 tons have already been written for October. On account of the disaster in the Norrie mine the shipments from Ashland, Wis., show a falling off for the week of over 30 per cent. The total shipments for the season to Oct. 5 were 1,997,135 tons.

Pennsylvania Compound for Fast Passenger Service.

The Pennsylvania has just completed at the Altoona shops the passenger engine with 7 ft. driving wheels, the plans of which were made several months ago, as announced in these columns. It is a 2-cyclinder compound, and weighs 72½ tons. There are four driving wheels 7 ft. in diameter and the weight on them is 90,000 lbs. The boiler pressure is 200 lbs. per sq. in. The high pressure cylinder is 19½ in. and the low pressure 31 in. in diamater, and the stroke is 28 in. The boiler is 5 ft. in diamater and 27 ft. long. The grate is 40 in. wide and 9 ft. long. The valves are piston valves 12½ in. in diamater and are placed between the cylinders. This type of engine will be known as Class T, and the number of this one is 1515. The truck wheels are 42 in. in diamater, steel tired, with wrought iron centres. The tender has only three pairs of wheels 42 in. in diameter.

Lake Shipbuilding Notes.

A steel freight steamer for Eddy Bros., Bay City, Mich., is nearly ready for launching at the Wyandotte yards of the Detroit Dry Dock Co. This steamer is 362 ft. long, 42 ft. wide, and 24 ft. deep, and is to be fitted with triple expansion engines having cylinders 22, 35 and 56 in. in diameter by 44 in. stroke, and two Scotch boilers 14 ft. 2 in. by 11 ft. 6 in. The cost will be $225,000. The same company is to build two side-wheel steel passenger steamers for the Detroit & Cleveland Steam Navigation Co., at a cost of $275,000 each, which are to have the following dimensions: Length, 264 ft.; beam, 38

ft.; depth, 15 ft; engines, compound beam; cylinders, 42 in. diameter by 7 ft. 5 in. stroke and 66 in. diameter by 11 ft. stroke; boilers, four, 11 ft. by 11 ft., fitted with Howden's system of forced draught. The speed is to be 18 miles per hour. Also a steel freight steamer for the New York Central line, which is to be 310 ft. long, 42 ft. beam and 26 ft. deep. The engines will be triple expansion; cylinders, 23, 38 and 62 in. diameter by 48 in. stroke. There will be two double end boilers, 11 ft. 6 in. diameter by 18 ft. long. The cost is to be $220,000.

At the yards of F. W. Wheeler & Co., West Bay City, Mich., a steel tug for use at New Orleans is nearly completed. This tug is 106 ft. long over all, 23 ft. beam, 11 ft. deep, and has a triple expansion engine having cylinders 16, 24 and 40 in. in diameter by 28 in. stroke. The same firm is building three steel freight steamers as follows: one for the Hawgood-Avery Co., of Cleveland, 360 ft. keel; 377 ft. 6 in. over all; 45 ft. beam, and 12 ft. 1 in. deep; engines, triple expansion; cylinders, 23, 37 and 62 in. diameter, by 44 in. stroke; three Scotch boilers 12 ft. 6 in. diameter, by 12 ft. long; cost to be about $225,000. One steamer for D. C. Whitney, of Detroit, which is the duplicate of the above. One steamer for the Mitchell Transit Co., which is to cost about $215,000, and is to be 345 ft. long over all, 328 ft. keel, 42 ft. beam, and 12 ft. deep. There is on the stocks at the same yard a wooden steamer for Hawgood & Canfield, Cleveland, which is 291 ft. long at keel, 41 ft. beam and 23 ft. deep. The engines are to be triple expansion, with cylinders 20, 32 and 54 in. in diameter, by 42 in. stroke. There will be two Scotch boilers 12 ft. in diaemter by 12 ft. long. The cost will be $130,000.

THE SCRAP HEAP.

A Station Indicator.

An English company is introducing an automatic station indicator to be placed in railroad cars. It is well known that contrivances of this sort have often been made, but none have succeeded yet so well as to replace the inarticulate trainman. An automatic indicator, when it gets out of order, tells a plain and legible lie, and thus is dangerous; but the trainman, whether he is in order or not, while he annoys you, does not mislead you seriously, for you cannot understand what he says anyway. The English machine consists essentially of a cylinder fixed in the car roof which displays the names of the stations. This cylinder is actuated by simple mechanism driven by contact with a curved guide or rail set in the track.

Long Engine Runs in England.

On the Midland Railway freight trains are dispatched direct from Bradford to London, 208 miles, without change of engine. Similar trains also run from Leeds to London, 196 miles, and from Manchester to London, 185 miles; while the longest passenger train journey of the same description is the well known run of the London & Northwestern locomotive "Charles Dickens," which for years has taken a train daily from Manchester to London and back, a distance of 372 miles, or 186 miles in each direction. Another notable run is that from Dublin to Cork, a distance of 165½ miles by rail, which is accomplished by the Great Southern & Western Railway Co.'s train that conveys the outward American mails every Sunday morning for embarkation at Queenstown.—*Iron.*

British Shipbuilding.

The state of the shipbuilding trade on the Clyde is daily becoming more depressed. It is stated that out of 148 berths only 49 were occupied with shipbuilding. It is estimated that 15,000 men are idle, and many departments are working three-quarter time. In Dumbarton the riveters, usually the best paid workers in the trade, are offering themselves as laborers. Many have gone to Barrow, Belfast, and the east coast in search of employment. At an adjourned conference at Sunderland, between the shipbuilders on the northeast coast and the representatives of the Boilermakers and Iron Shipbuilders' Society a settlement of the wages dispute was effected. The whole of the shipyards on the Tyne, Wear, and Tees were said to be represented, and the men's delegates were also numerous. After three hours' discussion the men agreed to a reduction of 5 per cent. off all piece prices, to take effect from the first full pay in October, and of 1s. 6d. per week reduction in time wages, dating from first pay in November.

LOCOMOTIVE BUILDING.

The Receivers of the Valley road (Ohio) will purchase two locomotives as soon as the court grants them permission.

The Baldwin Locomotive Works has just delivered to the Atlantic Coast Line five new locomotives, two being Vauclain compounds. All the locomotives have driving wheels 5 ft. 8 in. in diameter.

CAR BUILDING.

The Pennsylvania Co. is asking bids for 650 cars.

The Queen & Crescent is asking bids for 1,000 cars.

The Concord & Montreal is asking bids for 10 passenger cars.

The Wabash has ordered 500 box cars from the Madison Car Company.

The Toledo & Ohio Central has let 1,000 cars to the Michigan Peninsular Co.

The Receivers of the Valley road (Ohio) have purchased six passenger cars from the Jackson & Sharp Car Co.

The Superior Rapid Transit Company, of West Superior, Wis., is in the market for 10 closed electric railroad cars.

The receivers of the Valley road (Ohio), have been authorized to sell 200 freight cars and replace them with new cars.

The Lake Shore & Michigan Southern has given an order for 600 box cars to the Michigan-Peninsular Car Co., of Detroit.

C. N. Parker, of Brainerd, Minn., is about to place an order for four closed cars for use on the electric street railroad in that city.

The Atlantic Coast Line is building at its Wilmington shops 300 freight cars, of which 225 are ventilator cars equipped with the Janney coupler and Westinghouse air brakes. Fourteen first class passenger and express cars are also being built.

BRIDGE BUILDING.

Boston.—The Board of Aldermen has passed an order requesting the Mayor to petition the next legislature for the passage of an act authorizing the city of Boston to borrow outside the debt limit $500,000, to constitute a special appropriation for a new bridge to Charlestown.

Demorest, Ga.—Proposals are being received for a new bridge 150 ft. long, to be built across Hazel Creek on Central avenue.

New York City.—Property owners north of the Harlem River on the east side of the city who have organized the Willis Avenue Bridge Association, are agitating the building of a bridge across the Harlem River from First avenue and 125th street to Willis avenue and the Southern Boulevard. An effort will be made to secure the necessary authority at the next session of the legislature.

Omaha.—Press dispatches state that the Interstate Bridge & Street Railway Co., which was organized several years ago, has been reorganized as the Omaha Bridge & Terminal Co., and that bonds for building the bridge across the Missouri River to East Omaha have been sold.

Philadelphia.—The lowest bid received by the Director of Public Works for repairing the Girard Avenue bridge was from Benner & Opdyke, of Philadelphia. The bid was for $36,900, but only $29,000 is available for the work.

Pueblo, Col.—The Bessemer City Council has adopted plans for the Northern avenue viaduct in that city, and the city clerk has been instructed to advertise for bids according to the plans adopted.

St. Louis.—Plans have been drawn for the Clark avenue bridge, which is to be built from Eighteenth to Twentieth street, spanning the new Union station. The cost of the bridge will be borne by the Terminal Railroad Association of St. Louis.

Sealey, Tex.—The contract for the large bridge over the Brazos River near this place on the Houston extension of the Missouri, Kansas & Texas has been let to the Youngstown Bridge Company.

Sorel, Que.—A deputation from the Council and Board of Trade of Sorel recently waited on the Government at Ottawa and asked for a subsidy toward building a bridge over the Yamaska River, the cost to be $130,000. The old bridge was swept away last spring.

Toronto.—A special meeting of the City Council has been called for this week to approve the new plans which have just been completed for a high level bridge over the Don River. The bridge will cost about $250,000, and the plans have already been approved by the Board of Works.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Maine, semi-annual, 4 per cent.

Central of New Jersey, quarterly, 1¾ per cent., payable Nov. 1.

Chicago, Milwaukee & St. Paul, semi-annual, $3.50 on the preferred stock, and $2 on the common stock, payable Oct. 20.

Long Island, quarterly, 1¼ per cent., payable Nov. 1.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Alabama & Vicksburg, annual, Jackson, Miss., Nov. 7.

Atchison, Topeka & Santa Fe, annual, Topeka, Kan., Oct. 27.

Central Massachusetts, annual, Boston, Mass., Oct. 26.

Cleveland, Cincinnati, Chicago & St. Louis, annual, Cincinnati, O., Oct. 26.

Danville & Mount Morris, annual, New York City, Oct. 18.

Denver & Rio Grande, annual, Denver, Col., Oct. 18.

Evansville & Terre Haute, annual, Evansville, Ind., Oct. 17.

Housatonic, special, Bridgeport, Conn., Oct. 18, to approve of the lease to the New York, New Haven & Hartford.

Manhattan, annual, New York City, Nov. 9.

Manitou & Pike's Peak, annual, Manitou, Col., Oct. 15.

Montreal & Champlain Junction, special, Montreal, Quebec, Oct. 24.

New Orleans & Northeastern, annual, New Orleans, La., Nov. 2.

New York, New Haven & Hartford, annual, New Haven, Conn., Oct. 19.

New York, Pennsylvania & Ohio, annual, Cleveland, O., Oct. 12.

Northern Pacific, annual, Mills Building, New York City, Oct. 20.

Philadelphia, Newtown & New York, special, Norristown, Pa., Nov. 28, to consider an increase of bonds to $1,600,000.

Rio Grande Southern, annual, Denver, Col., Oct. 17.

Toledo, St. Louis & Kansas City, special, Toledo, O., Nov. 14, to consider an increase of bonds to $13,500,000.

Western Maryland Tidewater, annual, Baltimore, Md., Oct. 19.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Roadmasters' Association of America* will hold its next annual meeting at Lookout Mountain Hotel, Chattanooga, Tenn., beginning Nov. 15, having been postponed from Oct. 18.

The *New England Railroad Club* holds regular meetings, at the United States Hotel, Beach street, Boston, Mass., on the second Monday of each alternate month, commencing January.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* holds regular meetings on the third Thursday in each month, at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in he St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at Wesleyan Hall, Bromfield street, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 300, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o clock p. m. on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Association of Engineers of Virginia* holds regular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

The *Engineers' and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

American Society of Civil Engineers.

The Nominating Committee appointed at the last annual convention having presented to the Board of Direction nominations for officers for the ensuing year, the Board has, as required by the constitution, taken action upon the same, and has ordered the following nominations to be sent out for the information of the corporate members:

For President: William Metcalf, Pittsburgh, Pa.

For Vice-Presidents: Charles MacDonald, New York City; Elmer L. Corthell, Chicago, Ill.

For Directors: Foster Crowell and Henry G. Prout, New York City; Willard S. Pope, Detroit, Mich.; Frederic P. Stearns, Boston, Mass.; John T. Fanning, Minneapolis, Minn.; Olin H. Landreth, Nashville, Tenn.

For Secretary: Francis Collingwood, New York City.

For Treasurer: John Bogart, New York City.

California Association of Civil Engineers.

The California Association of Civil Engineers has elected the following named officers for the ensuing term: Hubert Vischer, President; C. E. Grunsky, Vice-President; Directors, George F. Allardt, William Ham Hall, James D. Schuyler, S. Harrison Smith, E. E. Tucker.

Civil Engineers' Society, of St. Paul.

William R. Mansel, John S. Beeston and Chas. A. Hunt were elected members of the Civil Engineers' Society of St. Paul at the regular meeting on Oct. 3.

Association of Railway Claim Agents.

It has been decided to hold the next meeting of this association at the Maxwell House, Nashville, Tenn., on Dec. 6 next. A meeting of the association will also be held at the Hotel Iroquois, Buffalo, N. Y., July 11, 1893.

American Street Railway Association.

The eleventh annual meeting will be held at Association Hall, Cleveland, O., on Oct. 19, and continue for three days. The programme of the meeting includes reports by special committees on "A Model Electric Street Railway Roadbed, and Underground Wiring," "Economy of Machine Shops for Electric Street Railways;" "Power-House Engines," "Experiments on the Expansion of Continuous Rails," "Is a Standard Rail-Head Possible?"

H. J. Davies, Secretary of the Brooklyn Street Railroad Company, of Cleveland, has charge of the exhibition of street railroad supplies. The present member-

ship of the association includes 108 street car companies in the United States and Canada. John G. Holmes, of Pittsburgh, is President, and William J. Richardson, Secretary of the Atlantic Avenue Railroad Company, of Brooklyn, N. Y., is Secretary and Treasurer.

Engineers' Club of St. Louis.

The club met Oct. 5, President Johnson in the chair, and 13 members and three visitors present. The committee appointed to consider the question of a change of quarters reported that they thought nothing could be done to better the situation by a change of rooms, but that it would be advisable to look for a house, and probably that other local societies would join in securing suitable quarters. It was announced that the following amendment to the by-laws would be brought up for action at the next meeting of the club. To introduce a new section as follows: Any member of any other society, in the Association of Engineering Societies, in good standing, may become a member of this club, when duly elected as described in Sec. 7, without paying the initiation fee, and with a release from the annual dues for such period, not over one year, as he may show by certificate he has paid in advance in the society from which he comes, provided such society shall have conferred like privileges on members of this club.

Mr. Ockerson exhibited a series of blue prints showing the changes in the Mississippi River channel for the last twelve years. Mr. Melcher exhibited a number of blue prints and photographs of the Lidgerwood machinery.

For the next meeting, Oct. 19, a paper on "Steam Engine Efficiency—Its Possibilities and Limitations," by Mr. W. H. Bryan, was announced.

New England Railroad Club

The regular meeting of the club will be held at the United States Hotel, Boston, Mass., Wednesday, Nov. 9, at 7:30 p. m. The subject for discussion: "Higher Speed of Railway Trains: System and Appliances Necessary to Accomplish It." The subject will be opened by Mr. C. A. McAlpine, Superintendent Northern Division, Old Colony road.

PERSONAL.

—Mr. R. S. Lovett, General Attorney for the Texas & Pacific, has resigned to engage in private law practice.

—Mr. W. W. Driggs, General Freight and Passenger Agent of the St. Louis & Hannibal, has resigned his position, to take effect Nov. 1.

—Prof. Lewis M. Haupt, late of the University of Pennsylvania, has been appointed Consulting Engineer of Quaker City elevated road of Philadelphia.

—Mr. L. F. Cowan, formerly Assistant General Freight Agent of the Monterey & Mexican Gulf, is now associated with R. L. Heffing, of Galveston, Tex.

—Mr. Dewy Hall, Assistant Engineer of the Louisville, New Albany & Chicago, in charge of bridge erection and repair at Delhi, Ind., was killed near that place Oct. 5.

—Mr. James Ritchie, Assistant Chief Engineer of the Cleveland, Cincinnati, Chicago & St. Louis, resigned that position last week, and will engage in business at Cleveland, O., where he formerly lived.

—Mr. N. Irish, Superintendent of the Cornwall & Lebanon road for the last six years, has tendered his resignation, to take effect Nov. 1, continued ill-health having incapacitated him from active duty.

—Mr. Frank Peters, Superintendent of Telegraph of the Southern Pacific for the last three years, died at San Antonio, Tex., last week of consumption. He had been unable to attend to his duties since July.

—Mr. O. W. Lamport, of Wabash, Ind., who recently accepted the general superintendency of the Chicago & Southeastern Road (Ind.), has resigned to accept the position of Secretary of the Fairmount Land Co.

—Mr. D. W. Rider, formerly Superintendent of the Jacksonville Southeastern, has been appointed Superintendent of the Kansas City Belt Railway, vice Mr. Day K. Smith, resigned to accept service with another company.

—Mr. John M. Sullivan, of Richmond, Va., died at that place last week. He was formerly Master Mechanic of the Wilmington & Delaware, but for the past 20 years has been a Foreman of the Richmond Locomotive & Machine Works.

—Mr. W. Stevenson, General Superintendent of the Northern Division of the Lehigh Valley, has been granted a three months' leave of absence, and Mr. W. K. Nivers has been appointed Acting General Northern Superintendent.

—Mr. J. W. Wood, Third Vice-President of the Louisville & Nashville, in charge of its legal department, has resigned. It appears that the resignation was tendered about two months ago, to take effect at the annual meeting, which has just been held.

—Mr. A. W. Ecclestone, Chief Clerk of the passenger department of the West Shore, has resigned. Mr. Ecclestone has had an experience of nearly 18 years in the passenger business of various roads, but chiefly on the West Shore. He was Chief Clerk of the passenger department under the late Henry Monnett.

—Mr. Joseph Crandell, Superintendent of the Western division of the Fitchburg, has resigned to engage in mercantile business in Troy, N. Y. Mr. Crandall has held this position about five years and was previously connected with the Troy & Boston for over 20 years, and had been Superintendent and General Freight Agent since 1881.

—Mr. John Kirby, who for the last 34 years has been General Master Car Builder of the Michigan Southern & Northern Indiana and of the Lake Shore & Michigan Southern has retired from that position. Mr. A. M. Waitt has been appointed to the position vacated by Mr. Kirby, who continues in the service of the company, and will have supervision of construction of new cars built by contract.

—Mr. C. A. Hayes, formerly General Freight and Passenger Agent of the Central New England & Western, and since the lease of the road to the Philadelphia & Reading Division Freight Agent of that system, recently tendered his resignation to take effect on Oct. 15. He will be connected with the National Transportation Despatch Company.

—Mr. Edward W. How is reported to have been appointed Commissioner of Railroads in Mexico, with headquarters in the City of Mexico. Mr. How was formerly joint traffic manager of the Louisville, New Orleans & Texas and Newport News & Mississippi Valley, but resigned a few months ago. His first connection with the Mississippi Valley road was as General Freight Agent, and he had previously been Assistant General Freight Agent of the Southern Pacific.

—Mr. Oliver H. Dorrance, who died at Chicago, Sept. 24, was formerly connected with a number of Texas railroads. In 1876 he was Purchasing Agent of the International Great Northern, and in 1879 he became General Superintendent of the Gulf, Colorado and Santa Fe. He was afterward Division Superintendent on the Missouri Pacific, and in 1887 was connected with the Union Stock Yards Company, of Omaha. He was compelled to resign this position on account of ill health and for the past year had lived in Chicago.

ELECTIONS AND APPOINTMENTS.

Baie des Chaleurs.—Hon. J. R. Thibeaudeau has been elected President of the new company; Mr. Cooper, Vice President; and Messrs. C. N. Armstrong, J. Murray Smith and W. T Costigan, directors.

Boston & Maine.—The company is soon to open a general passenger and freight office in Montreal, Can.

Busk Tunnel.—At the annual meeting the following directors were elected: Joseph R. Busk, Theodore M. Davis, Arthur H. Sherman, Charles E. Sands, Joseph H. Bond, all of New York City.

Chicago Great Western.—J. Donovan having resigned, the office of General Roadmaster was abolished on Oct. 1. Division Roadmasters will report direct to H. Fernstrom, Chief Engineer.

Concord & Portsmouth.—At the annual meeting of this company, held at Manchester, N. H., Oct. 6, these directors were elected: J. J. Pickering, Portsmouth; J. B. Walker, Concord; J. J. Bell, Exeter; W. M. Parker, Manchester; W. A. Pierce, Greenland; Moody Currier, Manchester, and Wallace Hackett, Portsmouth. J. J. Pickering was elected President; Wallace Hackett, Secretary, and W. B. Stearn, Treasurer.

Dubuque & Sioux City.—At the stockholders' meeting, held at Dubuque, Ia., Oct. 3, the following directors were elected: Stuyvesant Fish, S. V. R. Cruger, E. T. H. Gibson, E. H. Harriman, New York; E. C. Woodruff, Elizabeth, N. J.; S. L. Dows, Cedar Rapids; A. S. Garretson, James J. Peavey, Sioux City; J. T. Harahan, J. C. Welling, Chicago; John T. Hancock, C. W. Mitchell, W. H. Torbert, John V. Rider, M. M. Walker, Dubuque.

Jacksonville, Tampa & Key West.—James Menzies has been appointed Assistant General Freight Agent of the road, of the Plant system.

Kelnor, Elbon & Shawmut.—G. M. Harrison, formerly of Newark, has been elected Treasurer of this Pennsylvania road.

Lackawanna, Lake Erie & Honesdale.—The directors of this new Pennsylvania company are: W. H. Dimmick, Honesdale, Pa., President; Henry J. Russell, W. W. Weston, H. P. Menner, Jacob F. Katz, Thos. J. Ham and Eben H. Clark, of Honesdale, and B. H. Throop, R. P. Black and E. C. Dimmick, of Scranton.

Lake Erie and Western.—At a meeting of the directors this week Senator Calvin S. Brice was reëlected President, and L. M. Schwan was reëlected Vice-President, Secretary, and Treasurer.

La Porte, Houston & Northern.—The incorporators are: A. N. York, T. W. Lee, J. H. York, C. G. Woodbridge, A. E. O. Blackwell and J. R. Holmes, of La Porte, Tex.; R. R. Greer and J. E. Hill of Nebraska, and R. R. Spaulding and A. N. Palmer, of New York.

Lehigh Valley—The offices of Superintendent of the Seneca division has been abolished and the Buffalo division has been extended to Sayre and will include all lines heretofore covered by the Seneca division. The Superintendent will be T. H. Fennell, who has been in charge of the Buffalo division since the retirement of E. Van Etten.

Louisville, New Orleans & Texas.—The annual meeting of the stockholders was held in Memphis, and the following directors were elected: R. T. Wilson, C. P. Huntington, William Mahl, William M. Johnston, Eugene Martin, A. C. Hutchinson, J. M. Edwards, Edward H. Pardee and J. E. Gates. The stockholders also elected R. T. Wilson, President; J. M. Edwards, Vice-President; C. H. Bosher, Secretary; F. H. Davis, Treasurer.

Manitoba & Northwestern.—F. H. Brydges, Second Vice-President, having resigned from the Board of Directors, the office of Second Vice-President has been abolished, and the position of General Manager has been created. W. R. Baker, heretofore General Superintendent and Treasurer, has been appointed General Manager. D. B. Hanna has been appointed Treasurer in place of Mr. Baker.

Maysville & Big Sandy.—The following directors were elected at the annual meeting of this company held in Covington, Ky., Oct. 5: M. E. Ingalls, W. P. Anderson, J. C. Daire, W. R. Johnson and W. H. Jackson. Mr. Anderson is the only new director.

Midland Terminal.—The officers of the company are H. P. Lillibridge, President; Henry Colbran, Vice-President and Treasurer; E. F. Smith, Secretary, and R. Newell, Jr., Chief Engineer and Manager, with office at Cripple Creek, Colo.

Missouri, Kansas & Texas.—The official announcement of the appointment of A. Faulkner, as General Passenger and Ticket Agent, which was reported several weeks ago, has just been announced. His headquarters will be at St. Louis. Captain Faulkner was General Passenger and Ticket Agent of the Houston & Texas Central for about 10 years.

Newport News & Mississippi Valley.—Thomas B. Lyenh, who is now in charge of the passenger department, has the title of Assistant General Passenger Agent, with headquarters at Louisville, Ky.

Norfolk & Carolina.—The annual meeting was held in Norfolk, Va., Oct. 6. The following officers were elected: President, Warren G. Elliott; Vice-President, H. Walters; Directors, W. T. Walters., B. F. Newcomer, W. J. Doyle; Michael Jenkins, of Baltimore, and C. G. Ramsey of Norfolk. Messrs. Jenkins and Ramsey were chosen Directors in place of Senator Calvin S. Brice of Ohio, and H. C. Fahnestock, of New York.

Northern Pacific.—A circular has been issued making the following announcement: The Northern Pacific having acquired the ownership of the Puget Sound & Alaska Steamship Company, it will be operated as the Puget Sound & Alaska division of the company, under the jurisdiction of the latter company's general officers. Walker Oates has been appointed Superintendent, with office at Tacoma, Wash.

Pittsburgh Junction Terminal.—The following officers and directors were elected at the recent annual meeting at Pittsburgh: President, Wm. Metcalf; Secretary and Treasurer, J. B. Washington; directors, William Metcalf, Campbell B. Herron, Thos. M. King, Reuben Miller; Alexander Bradley, Charles L. Fitzhugh and J. Painter, Jr.

Portland & Rochester.—The following is a list of the directors of this company elected at the recent annual meeting: George P. Wescott, Nathan Webb, William G. Davis, Chas. McCarthy, Jr., Portland; Frank Jones, Portsmouth, N. H.; Stephen J. Young, Brunswick; Joseph L. Ricker, Deering; Arthur Sewall, Bath; Frederick Robie, Gorham; William H. Conant, Clerk.

Richmond & Danville.—W. H. Tayloe, formerly Eastern Passenger Agent in New York, and more recently Chief Clerk of the Passenger Department at Savannah, has been appointed District Passenger Agent at Atlanta, Ga.

St. Louis Southwestern.—W. L. Teague has been appointed Assistant Superintendent, with headquarters at Tyler, Tex., to succeed A. M. Haskell.

San Antonio & Aransas Pass.—Charles B. Peck, of Chicago, has been appointed Assistant General Manager of this road, a newly created position. His headquarters will be at San Antonio, Tex.

Seaboard & Roanoke.—John M. Robinson was reelected President at the annual meeting, and R. C. Hoffman, Vice-President; Enoch Platt, Louis McLean, M. Robinson, R. S. Tucker and L. R. Watts, Directors.

Southern Pacific Co.—W. E. Halm has been appointed General Agent for Colorado, in charge of the freight and passenger business, with office at 1652 Lawrence street, Denver. David R. Gray has been appointed General Agent, with office at 18 East First South street, Salt Lake City, Utah, vice W. E. Halm, removed to Denver.

Tobique Valley.—The present officers of the company are E. B. Ketchum, President; James Stratton, Secretary and Managing Director; C. N. Skinner, Keltie Jones and James Knox, directors. Frank Lawlor, Chief Engineer, St. John, N. B.

Union Pacific, Denver & Gulf.—Granville M. Dodge, of New York City, who has been President of the company since its organization, resigned this week, and has been succeeded by S. H. H. Clark, President of the Union Pacific, which controls the road.

RAILROAD CONSTRUCTION.
Incorporations, Surveys, Etc.

Astoria & Portland.—Corey Bros. & Co., of Ogden, Utah, have suspended construction work on this road and have secured a judgment for $230,000 against the company. The firm has employed quite a large number of men during the spring and summer on the grading and tunnel work south of Astoria, Or., and they state that no payment has ever been made to them for their work. The approaches to the tunnel on Saddle Mountain have been practically completed, and it was proposed to bore the tunnel during the winter. One of the firm of contractors states that Mr. George Goss, Superintendent of Construction, left Oregon for New York some time ago, and he thinks that he may be able to adjust their claim so that the work can be continued through the rainy season. All the laborers have been discharged, and the grading outfit is scattered along the line.

Butte, Anaconda & Pacific.—A charter for this company was filed in Montana last week by Marcus Daly and others, the capital stock being placed at $3,000,000. This new road has been discussed for nearly two years and in May 1891 proceedings were begun to organize a company to build the line. It is proposed from Butte west to the smelters at Anaconda, of which Marcus Daly is the principal owner. The line will be about 25 miles long and will be very expensive to build. The survey has been made down Silver Bow Creek for a short distance and thence along the foot hills to Anaconda.

Canada Western.—The British Pacific Construction Co., Ltd., has been organized at Victoria, B. C., to construct this road. The trustees are Messrs. Rithet, E. Crowe, Baker, Wm. F. Butler, Marvin, Wm. J. Macauley, Theodore Lubbey, Joshua Davies, Chas. Vernon and Frank Bakeman.

Central Counties.—James Shanly, C. E., left Montreal Oct. 11 to locate a road from South Indian, in Russell County, to Rockland, Que., on the Ottawa River, a distance of 17 miles. The road will be built by the Central counties and will be operated by the Canada Atlantic.

Charleston, Sumter & Northern.—The branch which has been building during the summer from Bennettsville, southeast to Gibson Station, S. C., is now practically completed, but the work on the last 10 miles will probably delay the opening of the branch. Gibson is a station on the Palmetto road, a branch of the Seaboard Air Line, and the new connection practically gives that system an entrance to Charleston, S. C.

Chickasawhay & Jackson.—Governor Stone has granted a charter to this company. The terminal points of the road are the west bank of the Chickasawhay River in Wayne County, Miss., and a point on the New Orleans and Northeastern in Jones County, Miss. The incorporators are: Geo. W. Robinson, East Orange, N. J.; John D. Cameron, Mobile, Ala.; Frank S. Robinson and E. W. Monahan, Moss Point, Miss., and Edward W. Robinson, Bucatunna, Miss.

Columbus & Sandusky Short Line.—An excursion train carrying a number of invited guests was run over the line last week as far as Attica, O., being the first train on the new road south of Bellevue. That town is about 13 miles south of Sandusky, and the terminus is 12 miles beyond Bellevue. The new road is being built in the interest of the Columbus, Shawnee & Hocking, and has been located south to Columbus 95 miles. Construction is progressing slowly, the grading having now reached Bucyrus, O.

Corpus Christi & Eagle Pass.—It is stated that a survey will be begun in a few weeks for this line, which is projected along the Rio Grande River from Eagle Pass to Laredo, Tex. The company was chartered a few days

ago in the interest of an Eastern land syndicate which owns coal land near Eagle Pass.

Elkhorn & Old Baldy.—Articles of incorporation of this company were filed in Montana recently to build a road from the Elkhorn mill in Jefferson county to Dry Gulch, thence to Queen Gulch to the summit of the mountains and down the western slope to the base of Old Baldy. The incorporators are T. H. Kleinschmidt, George H. Hill, E. W. Knight, Jr., Henry H. Hill and William R. Logan.

Elk Mountain.—A lien for $27,550 was filed against this company last week by James H. Wigglesworth, formerly Chief Engineer, for four years' salary at $500 a month as Chief Engineer, the balance being due him as contractor. The company has done some grading near Carbondale, Col., and last spring nearly 800 men were put on the work.

Georges Valley.—Work on the road from Warren to Union, Me., has been suspended temporarily. The trouble arises from the failure of the town of Union to comply in all respects with the agreement relating to its subscription in aid of the road.

Great Northern.—Excellent progress is being made on the construction of the Pacific Coast extension, especially west of the summit of the cascades. It is expected to complete the tracklaying in January. Track is being laid at the rate of two miles a day, and on the western division has reached Granite Rock, about 42 miles east of Snohomish.

Houston Belt & Magnolia Park.—It is stated that the company has agreed to extend its line, now terminating in Magnolia Park to Harrisburg, Tex., a distance of three miles, where it has been given large wharfage privileges on Buffalo Bayou, and will connect with the La Porte, Houston & Northern.

Huntingdon & Broad Top.—The short coal branch up Shreve's Run was completed early in October and is now in operation. It is only 1¼ miles long, and leaves the present line at Six Mile Run, reaching new coal mines from which a large traffic has been promised. The new road has a grade of 250 ft. to the mile. The work was all done by the company.

Illinois Central.—The railroad officers deny the recent newspaper story that the company has decided to build immediately a branch from Clinton to connect with the Louisville, New Orleans & Texas at Amite, Miss.

Lackawanna, Lake Erie & Honesdale.—The charter of this company was filed in Pennsylvania last week. The new road is to extend from the Borough of Honesdale, Wayne County, Pa., to a point on the Delaware, Lackawanna & Western, near Moscow, Lackawanna County, Pa. The length of road is 24 miles, and the capital stock is $750,000.

Lake Manitoba.—Charles Mackintosh, M. P. for Ottawa, was in Winnipeg, recently, and stated that arrangements had been made for the construction of this line from Portage la Prairie, Man., west of Lake Dauphin, to Lake Winnipegoosis. The Dominion Government, he says, has set aside 800,000 acres for the enterprise, and it is expected that the provincial government will assist it at the approaching session. It is promised that work will commence next spring.

La Porte, Houston & Northern.—The charter of this company has just been filed, although the road has been under construction for some time and has been practically completed between La Porte and Harrisburg. The charter is for the line from La Porte to Houston, 22 miles. The capital stock is $300,000.

Manitoba & Northwestern.—Messrs. Montague Allen and Nicoll Kingsmill left last week for Europe to complete financial arrangements for the construction of the extension of this road to Prince Albert, Man.

Memphis, Hot Springs & Pacific.—Articles of incorporation were filed in Arkansas last week by this company, with a capital stock of $1,500,000. The road is to extend from Little Rock in a southwesterly direction through Pulaski, Saline and Garland counties to Hot Springs. The incorporators are B. E. Orr, of New York, D. C. Rugg, of Hot Springs, J. W. Rose and W. A. Compton, of Little Rock. The Arkansas Contract Company of New Jersey has subscribed for $60,000 of the stock.

Mexican International.—The last track on the Durango extension was laid last week with much ceremony, newspaper reports saying that 15,000 people were present. The extension has been ballasted as the track has been laid, so that there will be little delay in opening the entire extension, which is 156 miles long. The line has been placed in operation as soon as completed, and trains have been running for 123 miles south of Torreon, Mex., for some time.

Mexican Southern.—The line to Oaxaca, Mex., which has been building for two years, has been completed to that city and was opened on Oct. 7. The track south of Tecomavoca, Mex., to Oaxaca, about 90 miles, has been laid in 1892.

Midland Terminal.—This is the legal title of the company which is building the branch of the Colorado Midland to the Cripple Creek mines in Colorado. Five miles of the grading north of Hayden Divide near Midland, Col., where the new road leaves the line of the Colorado Midland, has been already completed and a large force of men is now at work. The road is to be in operation by Jan. 1. The company proposes to build 22 miles from the new town of Midland north to Cripple Creek. R. Newell, Jr., of Cripple Creek, Col., is Chief Engineer and Manager.

Missouri, Kansas & Eastern.—The right of way along the bank of the Missouri River is said to have been assured the company, and it has agreed to build along that location. A survey had been recently commenced from a point near Bellefonte Bluffs, Mo., for an interior route, but this will now be abandoned.

Montpelier & Chicago.—Tracklaying has begun at New Paris, near the connection with the Cleveland, Cincinnati, Chicago & St. Louis. Two miles of track will be laid each day by the force working from that point. The track is also being laid on the eastern section.

New Roads.—Mr. J. F. Whitwell is surveying for the proposed road between Stanbridge Station and Philipsburg, Que. Operations will commence early in the spring.

Ohio Southern.—H. T. Douglas, Chief Engineer of the road, who has been engaged for some time on the survey of the proposed extension from Springfield to Lima, O., reached the latter city last week. The route is very direct and will be about 60 miles in length. The stockholders are expected to authorize the building of the extension at the meeting this week.

Oscawana & Cornell.—The New York State Railroad Commissioners granted this company last week the necessary authority to construct its proposed road through Westchester County, N. Y. The route has been pretty well described in the *Railroad Gazette*, and is from Oscawana station on the New York Central east to Cornell, near the site of the proposed aqueduct dam. Oliver W. Barnes, 57 Broadway, New York City, is Chief Engineer.

Philadelphia Belt Line.—Work was begun at Bridesburg, Philadelphia, last week on the trestle which the road is to build through low water in the Delaware from Reynolds street to a point above Fitler's Wharf. The start has been made above Bridge street, and the first section to be built will be from Bridge street to the Lennig Chemical Works.

Providence & Springfield.—The award to Ward Brothers of the contract for the extension of this road was noted last week. About 100 men are now at work, and it is expected to have the new line in operation by May 1 next. It will be operated under lease by the New York & New England which also operates the existing line from Providence to Pascoag, R. I., 23 miles. The road now being built is about 6½ miles long from Pascoag northwest, to connect with the New York & New England at East Thompson, Conn. Three iron bridges are to be built, but the work is not otherwise very heavy. The road is being built under the supervision of L. B. Bidwell, Chief Engineer of the New York & New England.

Quaker City Elevated.—It is understood that the company will soon be prepared to let contracts for the elevated structure. Detailed plans have been prepared for the structure on Market street, west as far as Ninth street. The elevated road will occupy the centre of Market street right over the street car tracks, and the outer edge of the structure will be 28 ft. from the house line on either side. Injunctions against the company asking that it be restrained from building have been granted on request of several firms along Market street, who allege that the road will deprive them of easy access to their houses and of light and air. City Solicitor Warwick has prepared a voluminous opinion in which he states that the elevated railroad companies have fully complied with their contract with the city and that Councils has no right to revoke their franchises.

Quebec, Montmorency & Charlevoix.—W. T. Cronston, Civil Engineer, accompanied by a staff of assistants, has left Quebec for Cape Tourment, from which poin the will commence the survey in connection for the extension to Chicoutimi, Que. Mr. Cronston will be absent for about six weeks. H. J. Beemer, the contractor, is pushing the work with all possible speed, and the road to Murray Bay is expected to be completed by June, 1893.

San Bernardino & Los Angeles.—Articles of incorporation were filed in California to build a road estimated to be 75 miles in length from Morengo Pass, near the city of San Bernardino, through Riverside to Los Angeles. The directors for the first year are D. S. Dorn, Samuel Miller and A. F. Johns, of San Francisco; M. H. Sherman, of Phœnix, A. T., and R. J. Davis, of Oakland, Cal. The capital stock is $2,000,000 and $75,000 has been subscribed—$15,000 by each of the directors.

Santa Fe, Prescott & Phœnix.—A report just received from G. W. Vaughan, chief engineer of this road, states that 60 miles of the line has been graded, up to date, leaving only a small portion of the division between Ash Fork and Prescott, Ariz., uncompleted. Six miles of the track has been laid.

Southern Pacific.—President Huntington has decided to push the work of filling in the gap on the coast division between Santa Margarita and Elwood, Cal. About a year ago the people of those counties procured free right of way for the 125 miles between the points mentioned, on condition that the company commence construction within 60 days thereafter. Since that time a small number of men have been working on the approaches to the tunnels. There is some very heavy tunnel work to be done immediately south of Santa Margarita. The right of way given to the company after running through the mountainous country for a distance of about 16 miles between Santa Margarita and the town of San Luis Obispo extends almost due south from the latter place, crosses the Santa Maria River, thence through the Gaviota pass, and westerly to the shore of the ocean, a number of miles northwest of Elwood. Only a part of this route may be used, as the company has made another survey further west with the idea of avoiding the Gaviota pass and the grades through the San Rafael Mountains. The filling in of the gap will make another through line between San Francisco and Los Angeles, via San Jose, Castroville, San Luis Obispo, Santa Barbara and Saugus.

Tennessee Midland.—The County Court of Davidson County, Tenn., has reconsidered its action refusing to submit to the people a proposition to subscribe $350,000 to the capital stock of this company. By a vote of 42 to 27 the Court then adopted a resolution submitting the proposed subscription to a vote of the citizens, and it will be voted on at the November election. The stock is to secure the extension to Nashville, which the company promises to build if the subsidy is voted.

Tobique Valley.—Lawlor, Conner & Co., of St. Johns and Andover, N. B., who are the contractors for the extension of this road to Plaster Rock, N. B., began work some time ago and at present have about 300 men employed. The grading and bridging is now well advanced, and tracklaying has commenced. About 14 miles of the road was built in 1891 from Perth, a station on the Canadian Pacific (formerly the New Brunswick road) northeast, and it is hoped to complete the entire line to Plaster Rock, 28 miles, by Jan. 1 next. The maximum grades are 80 ft. to the mile and the curvature is eight degrees. No iron bridges will be built, but a number of Howe spans, one of 116 ft., one of 60 ft., and two of 40 ft., and four trestles will be erected. The Dominion Government has granted a subsidy of $6,400 a mile for the first 14 miles of the road, and the Provincial Government a subsidy of $2,500. On the second 14 miles there is a Dominion subsidy of $3,200 a mile and a Provincial subsidy of $2,500. First and second mortgage bonds for $5,000 a mile have been issued, but these remain unsold and are held by the trustees, Douglas Hazen and Donald Carmichael, of St. Johns, N. B. The Canadian Pacific will operate the road, when completed, for 60 cent. of the gross earnings. The business to be developed will be the transportation of cedar shingles and gypsum.

Unadilla Valley.—A small force of men employed by G. M. Rusling, of 137 Broadway, New York City, began work at Leonardsville, N. Y., last week. Right of way has been secured by the company from Bridgewater south to Leonardsville, and the location is now being completed to South Edmeston and New Berlin, N. Y., 19 miles. About eight miles of the road was graded two years ago

Yankton, Norfolk & Southwestern.—It is stated in a local paper that all the grading will be completed this week south of the Missouri River to Norfolk, Neb., with the exception of a few places where the work is comparatively heavy.

GENERAL RAILROAD NEWS.

Central of Georgia.—The syndicate headed by H. B. Hollins & Co., of New York, formed for the purpose of readjusting the floating debt of the road, paid off on Oct. 7 the loan of $3,790,000 made by Speyer & Co. The amount, with interest, was $3,890,000, and the securities deposited with Spreyer & Co., as collateral when the loan was made, were transferred to Hollins & Co., who have undertaken the reorganization of the company.

Central of New Jersey.—The financial statement for the month of August was as follows:

	1892.	1891.	Inc. or dec.
Gross earn.	$1,311,944	$1,305,042	I. $6,902
Oper. expen.	778,210	744,073	I. 34,138
Net earn.	$533,734	$560,970	D. $27,236
Jan. 1 to Aug. 31:			
Gross earn.	$9 293,773	$9,144,838	I. $148,935
Oper. expen.	5,451,000	5,286,123	I. 164,877
Net. earn.	$3,842,773	$3,858,715	D. $15,942

Grand Trunk.—At the half yearly meeting in London, Eng., Oct. 31, the shareholders will be asked to sanction the taking over of the following short branch lines: The Jacques Cartier; Montreal & Champlain Junction; Beauharnois Junction; Midland; Peterborough & Chemung Lake; Lake Simcoe Junction; Grand Trunk, Georgian Bay & Lake Erie; London, Huron & Bruce; Galt & Guelph; Brantford, Norfolk & Port Burwell; North Simcoe; Waterloo Junction.. and the Cobourg, Blairtown & Marmora. Most of these lines are at present operated by the company.

Port Jervis, Monticello & New York.—At a meeting of the Board of Directors of the Port Jervis, Monticello & New York last week, the agreement to consolidate that road with the Philadelphia & New England and the Delaware & North River was duly ratified. The next step will be the formal ratification of the agreement by the Delaware & North River Co.

Rochester & Glen Haven.—The Rochester Trust & Safe Deposit Co., as trustee for the bond holders of the road, has commenced an action to put the road into the hands of a receiver. The bonds amount to $100,000. The road is short and the principal business is summer excursion travel.

Terre Haute & Peoria.—The mortgage recently authorized by the stockholders has been filed in Illinois. It is for $2,500,000, and is made in favor of the Union Trust Co., bearing five per cent. interest. About $1,800,000 of the new bonds will be used to refund the present indebtedness.

Toledo, St. Louis & Kansas City.—A special meeting of the stockholders will be held in Toledo, O., Nov. 14 and take action upon a proposition of the directors to issue the bonds to an amount not exceeding $30,000 per mile, or $13,500,000. The new bonds will be secured by a four per cent. consolidated first mortgage. Of the issue $9,500,000 will be reserved to retire the outstanding 6s. The remaining $400,000 will be used for permanent improvements, rolling stock and terminal facilities.

Western Counties.—The new stock, £275,000, will be used to pay off the existing liabilities of the road, including the indebtedness to the Nova Scotia government and the municipalities of Digby and Annapolis, relay the road with steel rails and put it in first-class condition. The syndicate desires to obtain possession of sufficient old common stock to give control, and has offered the municipality $20,000 of new debenture stock for its $100,000 of old stock.

TRAFFIC.

Traffic Notes.

The blockade of South bound corn at the Mexican frontier became last week heavier even than it was a week before, and one report stated that 2,000 cars were waiting. The Mexican roads had insufficient motive power, and besides that the narrow gauge roads had to transfer every load.

The Pacific Mail Steamship Company has reduced its rates from San Francisco to Mexico and Central American points. San Francisco merchants have found some difficulty in maintaining their trade with Mexico and Central America owing to Latin methods of trade, in which long credits are the rule, so strong inducements in low rates were needed to get their trade back.

Chicago Traffic Matters.

CHICAGO, Oct. 12, 1892.

The Central Traffic Association has voted on rates to the World's Fair. The single trip ticket plan was adopted, tickets to be sold to Chicago at a reduction of 25 per cent. from tariff rates and there will be a reduction of 25 per cent. on tickets *from* Chicago during the same time.

The rates to the dedicatory exercises of the World's Fair have been cut, in one instance, at least. The Baltimore & Ohio and Pennsylvania made a rate of one fare for the round trip from Columbus.

At the November meeting of the Western Passenger Association a proposition will be submitted in regard to World's Fair rates. From points within 200 miles of Chicago it is proposed to sell excursion tickets, good for return passage within 10 days from sale, at 15 per cent. reduction from the regular first-class fare both ways; from points beyond 200 miles, and within 400 miles of Chicago a reduction of 25 per cent. is proposed, and from points between 400 and 700 miles a reduction of 33⅓ per cent., these tickets to be good for return passage within 30 days and 60 days, respectively. From points outside the 700-mile radius it is proposed to sell excursion tickets, good for return passage within 90 days from date of sale, at one fare for the round trip.

The committee of Vice-Presidents and General Managers of Western roads, which met here last week with a view of formulating a plan for the reorganization of the existing associations, has abandoned the work for the time being and adjourned until November 10.

E. O. WESTINGHOUSE, JR., President. T. W. WELSH, Supt. JOHN CALDWELL, Treasurer. W. W. CARD, Secretary. H. H. WESTINGHOUSE General Manager.

THE WESTINGHOUSE AIR BRAKE COMPANY

PITTSBURGH, PA., U. S. A.,

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The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped. Below is a graphical illustration of the progress made in the application of the Automatic Brake to freight cars since its inception.

Year.	No. per year.	Grand total.
1881	105	105
1882	1,085	1,190
1883	4,966	6,156
1884	15,051	21,207
1885	10,410	31,617
1886	8,946	40,563
1887	9,281	49,844
1888	27,696	77,540
1889	26,065	103,605
1890	50,502	154,107
1891	39,061	193,168

193,168 freight cars fitted with the Westinghouse Automatic Brake, which is nearly 20 per cent. of the Entire Freight Car Equipment of this country.

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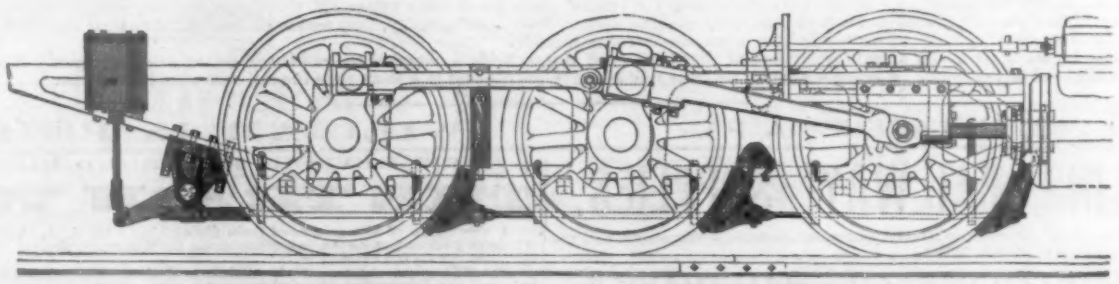

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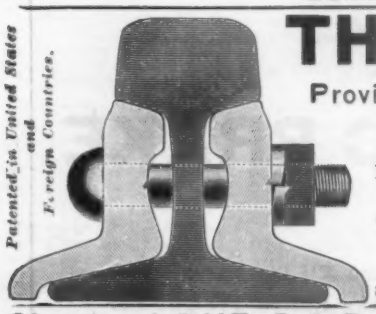

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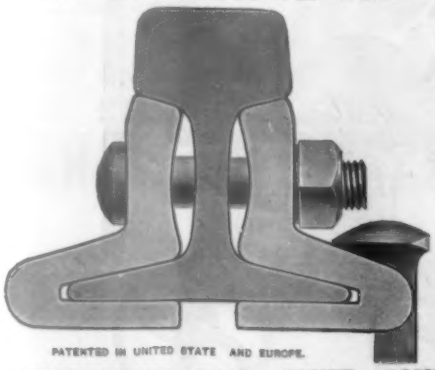

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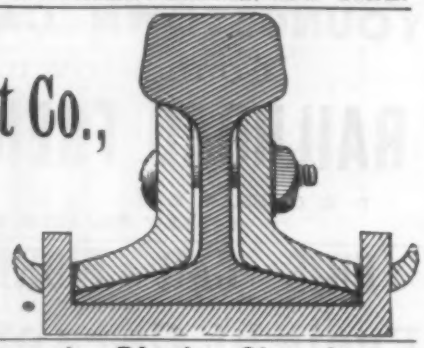

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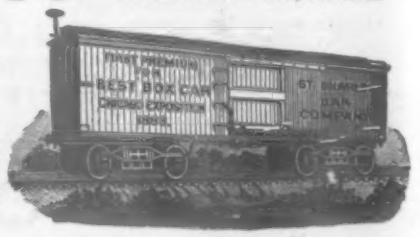
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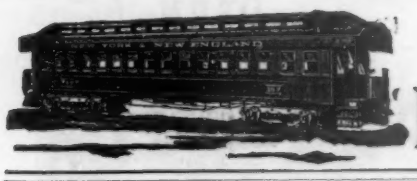
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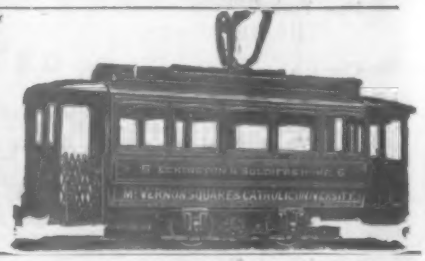

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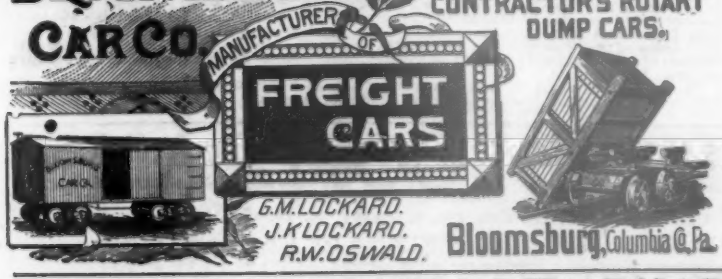

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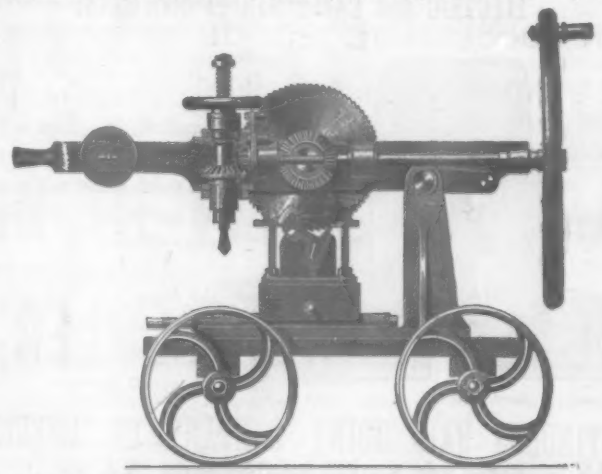
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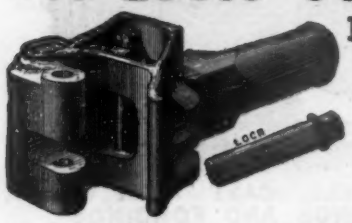

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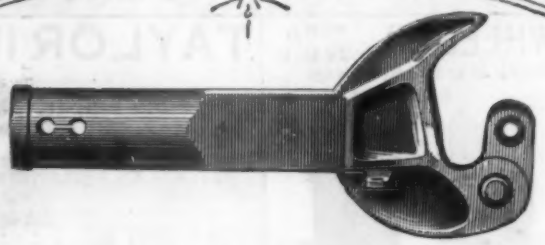

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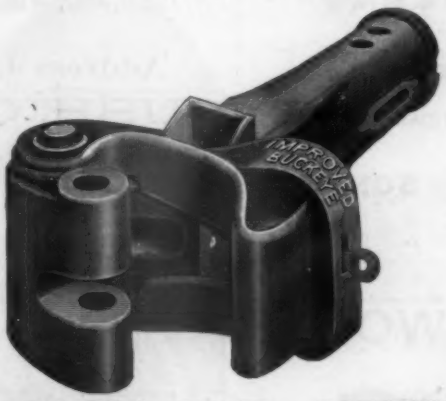

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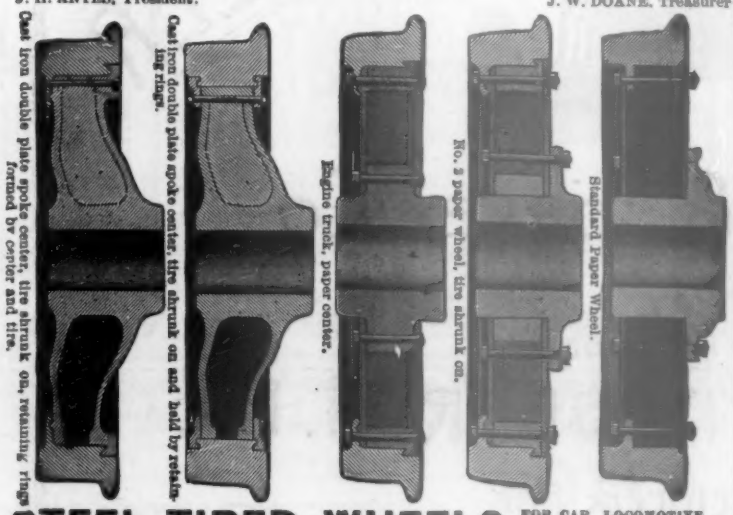
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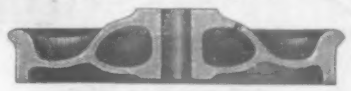

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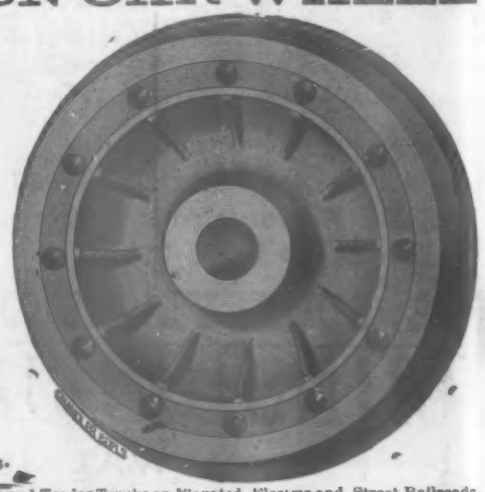

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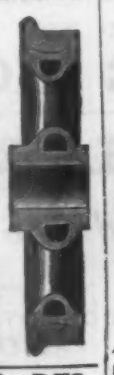

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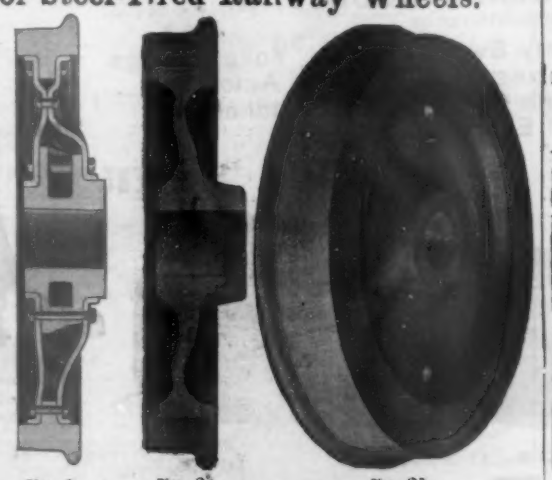

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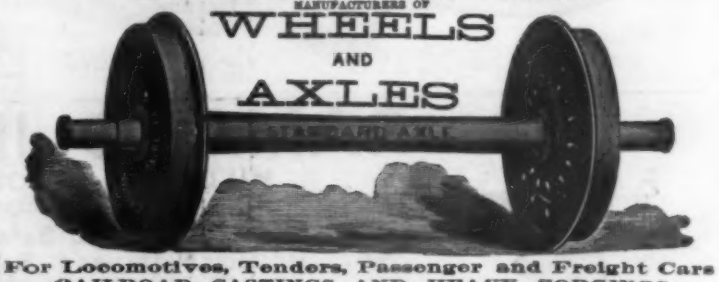

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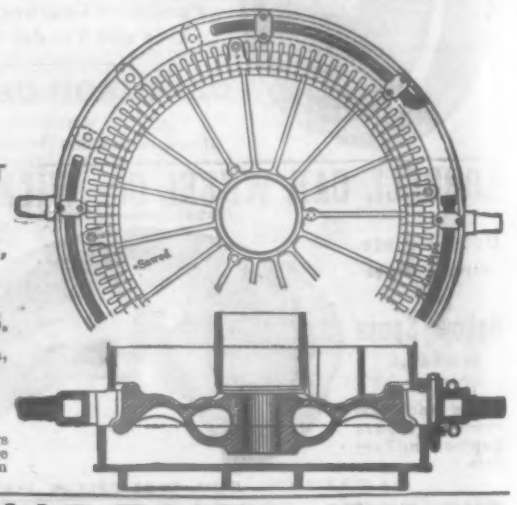

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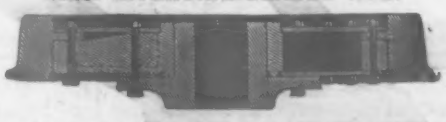

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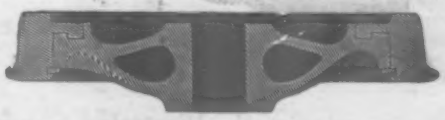

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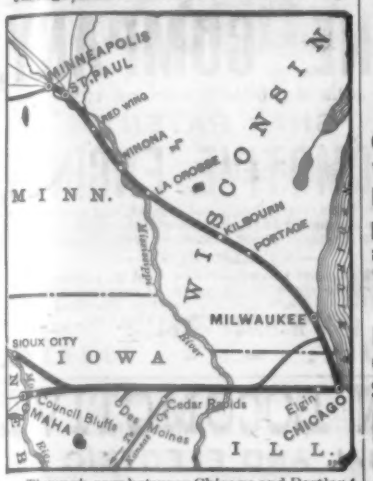

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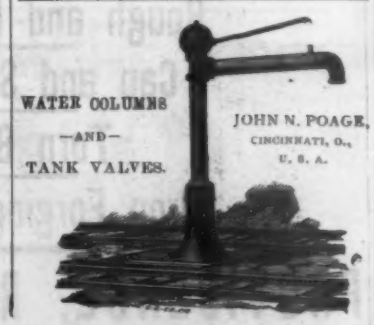

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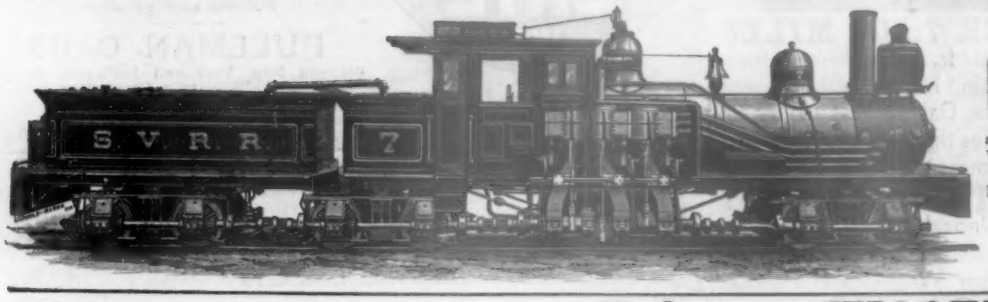

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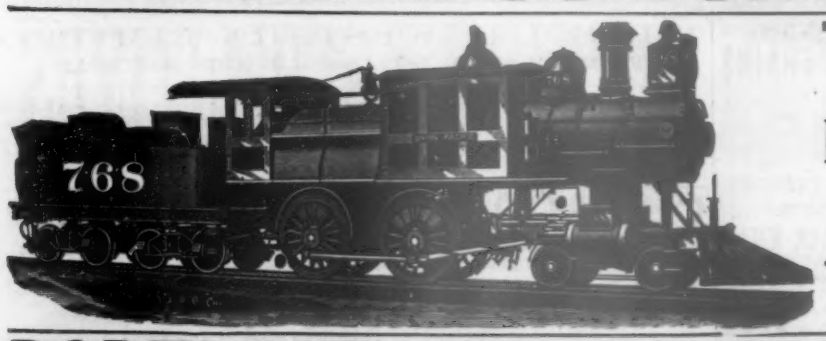

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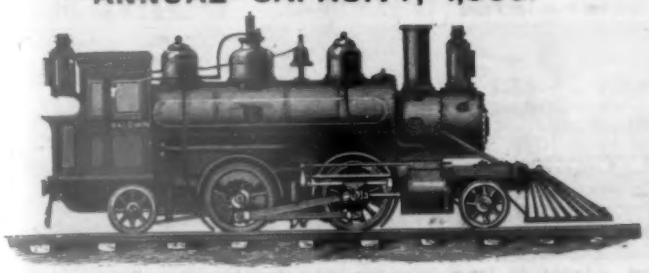

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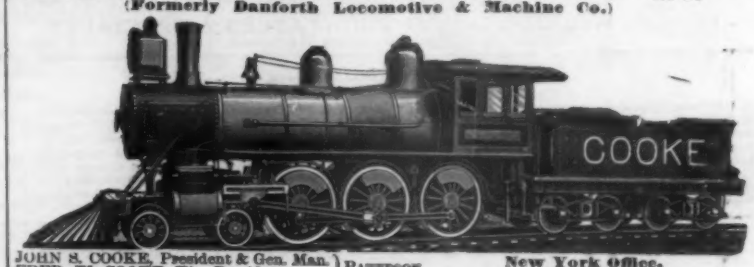

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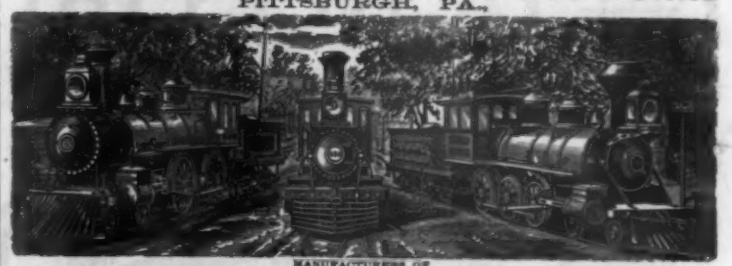

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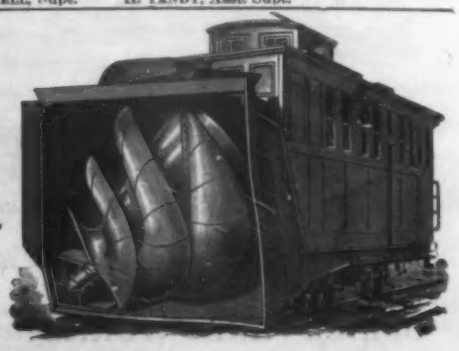

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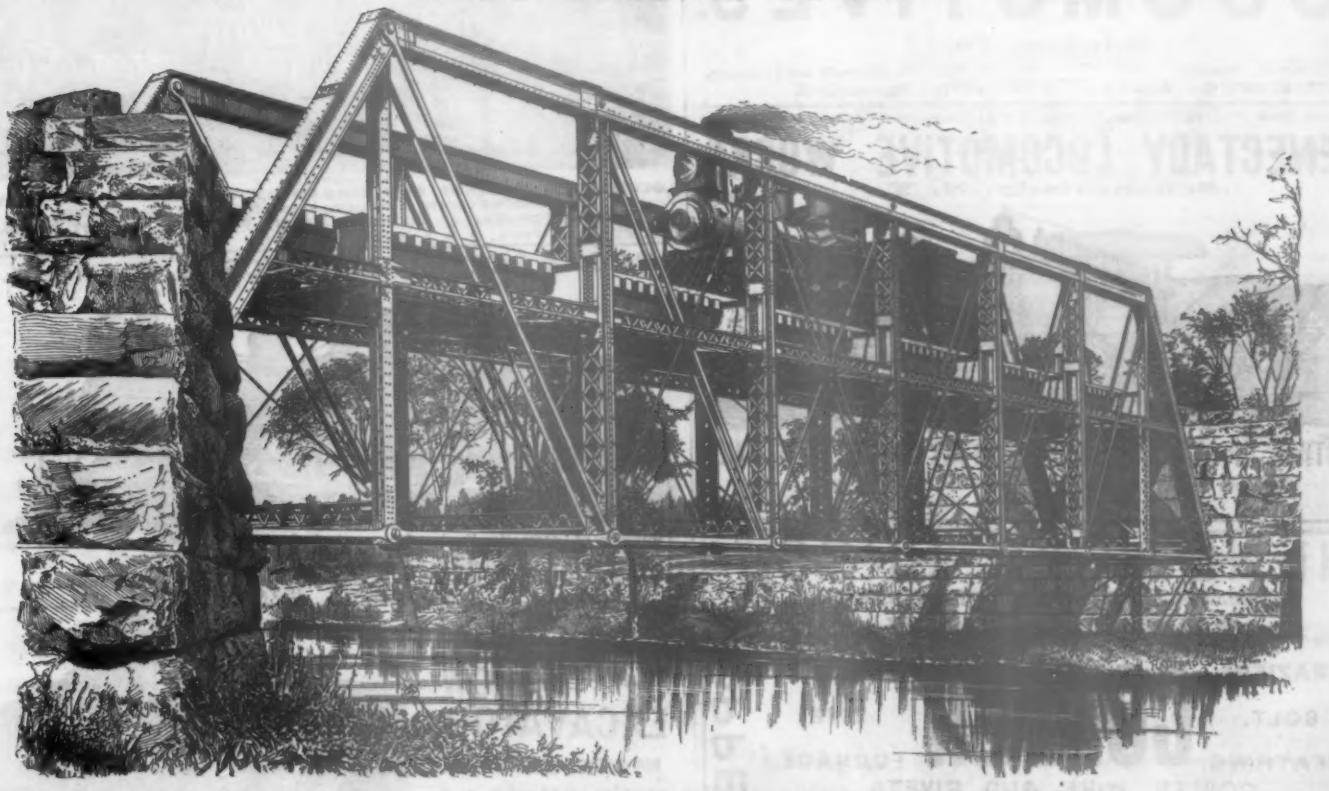

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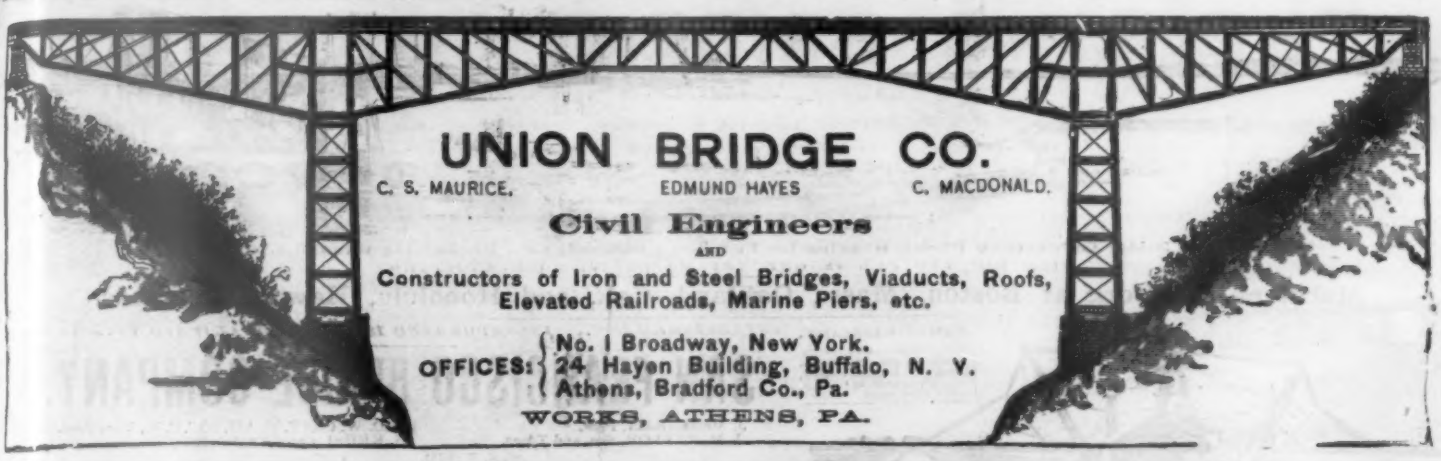

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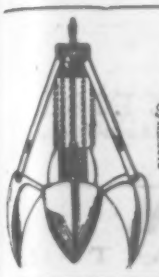

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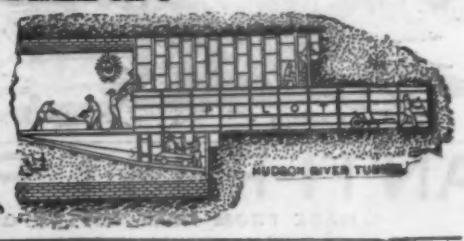

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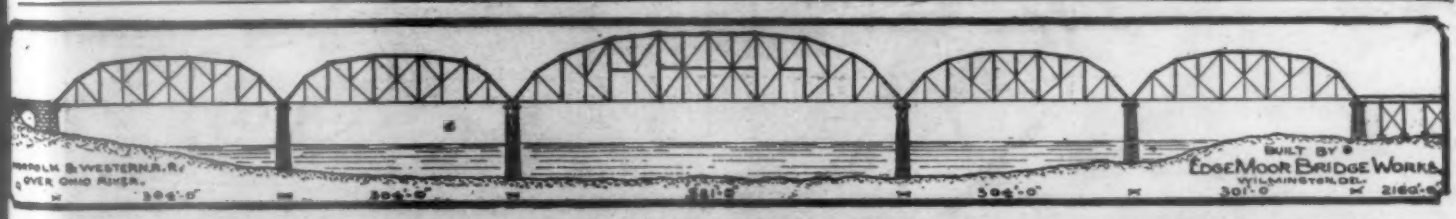

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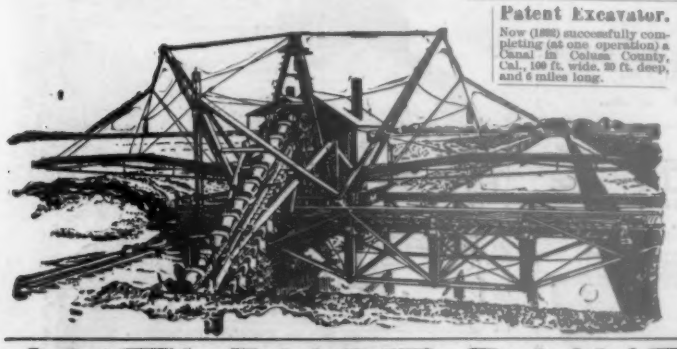

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New C. O. R. R. Bridge, Cincinnati, O.	Keystone Bridge Co.	Pennsylvania R. R.	Ohio & Miss. R. R.
Poughkeepsie Bridge.	Edge Moor Bridge Works.	Richmond & Danville R. R.	Col., H. V. & Tol. R. R.
New London Draw Bridge.	Pencoyd Iron Works.	Atlantic Coast Line.	Lake Shore & M. S. R. R.
Denver Cable Road.	Passaic Rolling Mill Co.	East Tenn., Va. & Georgia R. R.	Western N. Y. & Pa. R. R.
Cantilever Bridge, Niagara Falls.	Standard Oil Co.	Texas Pacific R. R.	Southern Pacific R. R.
Harvard Bridge, Boston, Mass.	New York Central & H. R. R. R. Co.	Illinois Central R. R.	A. T. & S. Fé. R. R.
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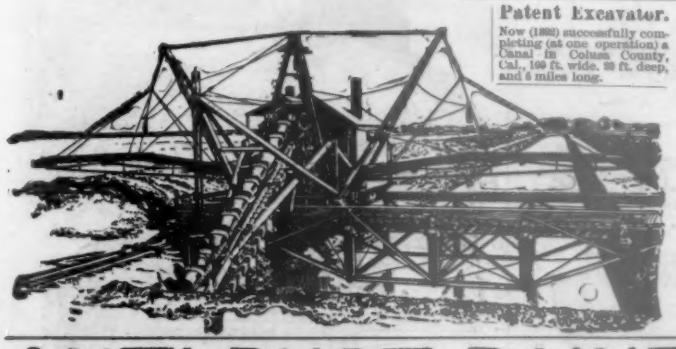

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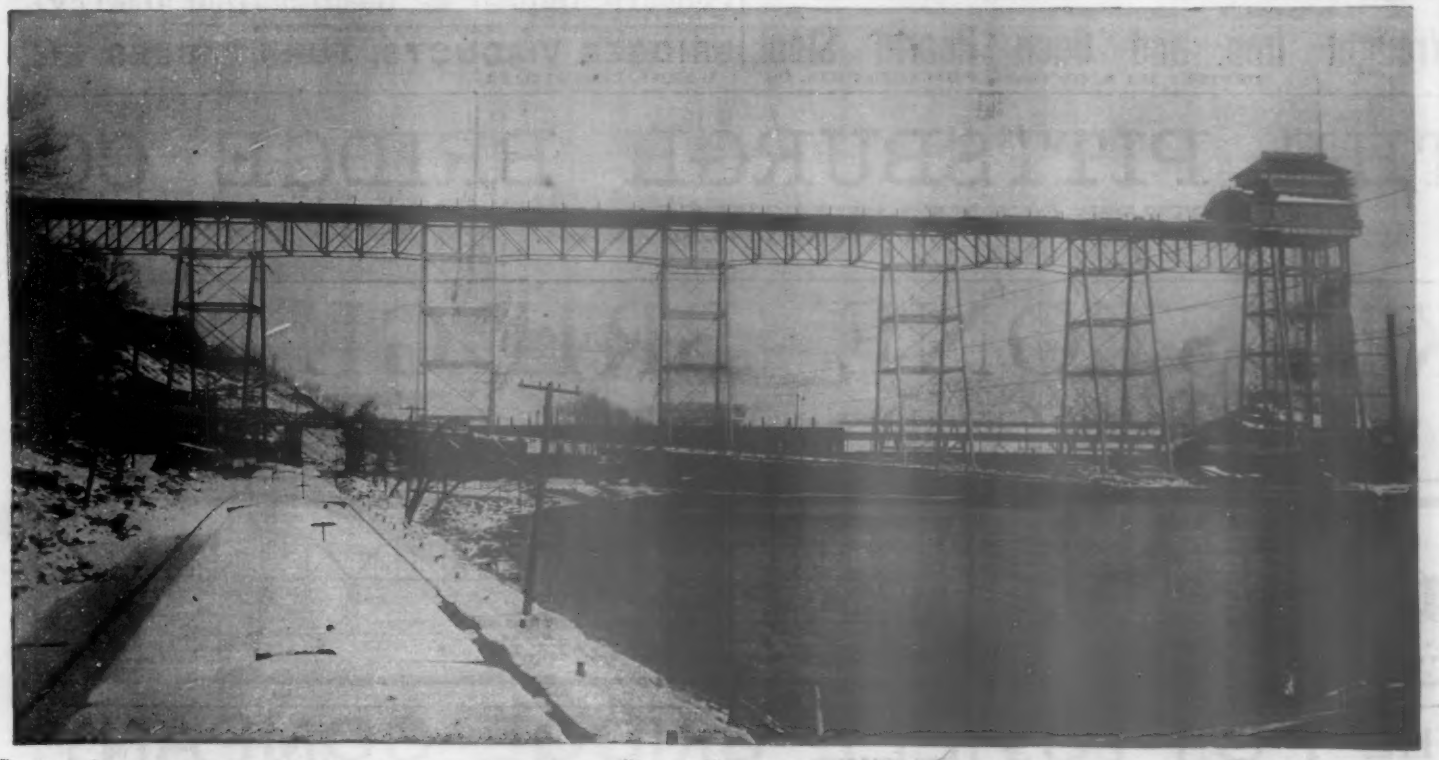

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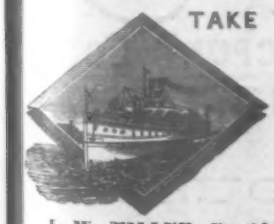

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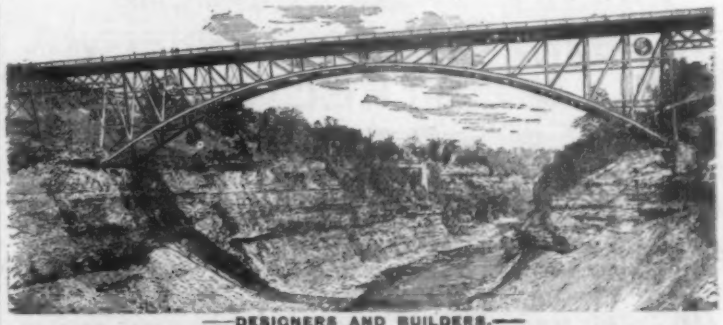

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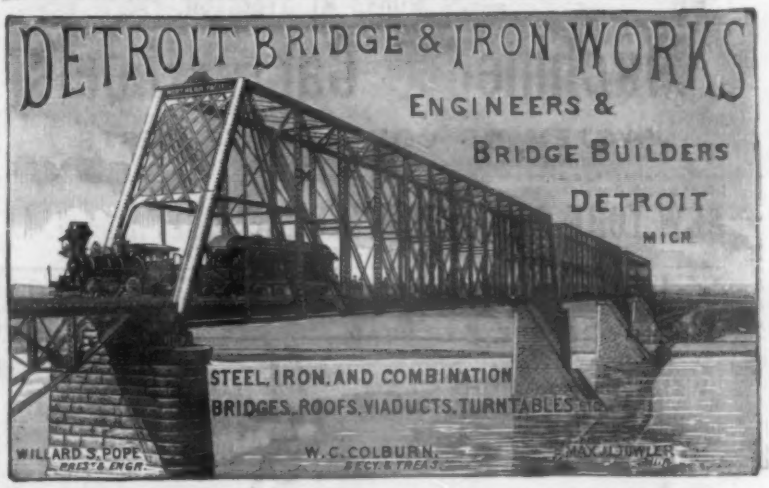

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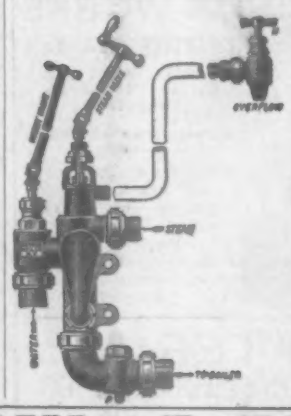

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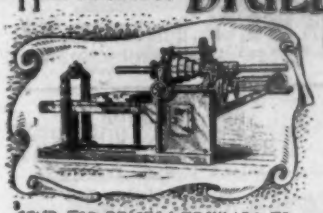
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